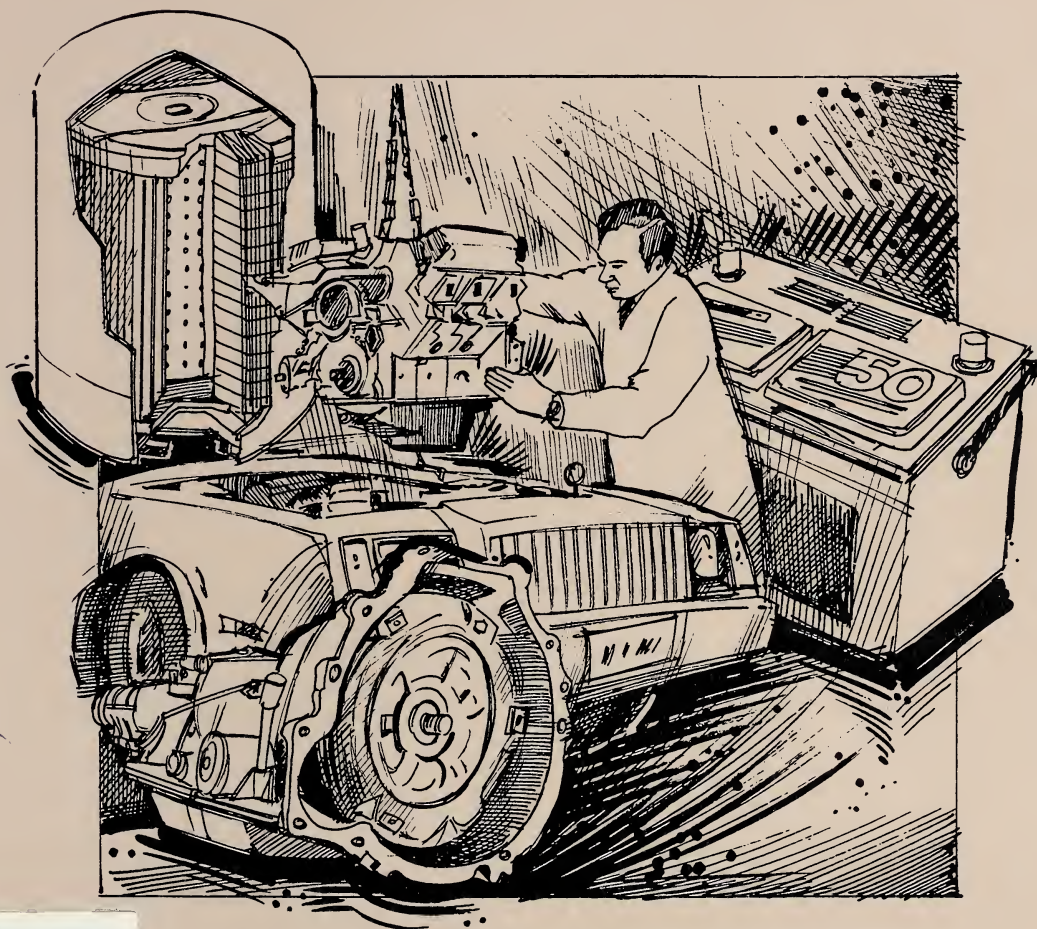


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Student Workbook

1992

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Read and complete the "Student Safety Pledge Form" below.

STUDENT SAFETY PLEDGE FORM

_____, who is enrolled in Automotive Services 36 will, as part of the learning experience, operate equipment and tools, providing written parent/guardian permission is given.* Each student will be given proper instruction, both in the use of the equipment and tools and in correct safety procedures, before being allowed to work alone. Because the student must assume responsibility for following safety practices, we ask that he or she subscribe to the following safety pledge.

1. I WILL FOLLOW ALL SAFETY RULES.
2. I WILL NOT ASK PERMISSION TO USE AN ITEM UNLESS I HAVE BEEN INSTRUCTED IN ITS USE.
3. I WILL REPORT ANY ACCIDENT OR INJURY TO THE TEACHER/SUPERVISOR.

DATE _____ STUDENT'S SIGNATURE _____

I hereby give my consent to allow my son or daughter to operate all equipment and tools necessary to carry out the tasks in this course.

DATE _____ PARENT'S/GUARDIAN'S SIGNATURE* _____

Parents/guardians are cordially invited to visit and arrange to view any tasks performed by the students.

*Parent/guardian consent is necessary only if the student is a minor.

SAFETY IS EVERYONE'S BUSINESS

The proper and safe use of equipment, tools and supplies protects you, others and property in both the school lab and in the workplace.

Job sheets in this workbook contain safety information (e.g., safety rules, practices, cautions, protective clothing/gear) where appropriate.

SAFETY PRACTICES AND PROCEDURES MUST BE FOLLOWED

Note: Safety practices may vary in different situations. **Always follow your teacher's/supervisor's instructions.**

INTRODUCTION

What abilities (knowledge, skills, attitudes) will you need to acquire in order to get and to keep an entry-level job in automotive services?

Having successfully completed Automotive Services 26, you could probably make lists of the things you should know, the jobs you should be able to do, and the attitudes considered appropriate in the workplace. In fact, this is a good starting point for this course, Automotive Services 36. The following activities will enable you to evaluate your present abilities and help to guide your learning during the course.

STUDENT ACTIVITIES

1. Either on your own, or through brainstorming, answer the following questions:
 - a. What knowledge, skills and attitudes are required to get and keep a job in automotive services?
 - b. List your answers in the following chart. Be specific. Different areas of the business/industry may require different abilities.

Area of Business/Industry	Knowledge (What I should know)	Skills (What I should be able to do)	Attitudes (How I feel about myself, others and the job)

- c. If you worked alone, compare your list with those prepared by classmates. If necessary, make changes to your list.
2. a. Check (✓) each of the abilities, listed in the chart, that you think you now possess. That is, do you now have the knowledge, skills and positive attitudes needed to obtain and keep a job?
- b. How do you intend to acquire the abilities not presently checked?

COURSE OUTLINE

During Automotive Services 36 you will be able to develop your abilities even further. At the end of the course, you should be able to:

- have a clear idea of your career options
- obtain entry-level employment in a related job
- recognize the need for further education and training
- identify opportunities for further education and training
- identify the knowledge, skills and attitudes relevant to automotive services careers
- demonstrate the skills required of personnel involved in automotive services.

The job sheets contained in this student workbook are examples of jobs you may perform as an entry-level employee. Because the types of jobs in this career field are many and varied, your teacher or supervisor may provide additional or alternative job sheets.

Evaluate your own performance on each job, and encourage classmates to criticize your work. For example: Is it done well? Does it need a little more work?

Appendix 1: "Automotive Services 36 Profile" provides an outline of the abilities you should have at the end of this course.

STUDENT ACTIVITIES

1. As you perform each job, ask yourself the following questions:
 - Is the work area properly arranged to do the job?
 - Are needed equipment, tools and supplies available and close at hand?
 - Is my personal hygiene, appearance and attitude appropriate for the job?
 - Are proper procedures and safety practices being followed?
2. When you complete each job, ask yourself these questions:
 - Am I satisfied with the completed job? Why or why not?
 - Could I have improved the finished product or service? How?
 - Is the teacher/supervisor/customer satisfied with the finished product or service? Why or why not?
 - With the abilities I now have, what jobs could I get in the community?
 - What other abilities do I need to acquire in order to apply for the type of job I want? How can I acquire these abilities?
3. Read Chapters 1 and 2, *Working: Today and Tomorrow*, Canadian Edition, 1990. Discuss and answer the following questions:
 - Will the job market increase or decrease for people in the automotive services industry during the next five years? Give reasons for your answer.

- What local, provincial, national or international factors may cause the job market in this career cluster to change?

Local _____

Provincial _____

National _____

International _____

JOBS AND CAREERS

How does a job differ from a career? You probably have an answer to this question by now. However, to review the difference, your textbook, *Working: Today and Tomorrow*, Canadian Edition, 1990, contains the following descriptions:

A job can be short-term (or long-term) employment; work you do because you need the money or because it's available.

A career is your life's work . . .

A career is an occupation that you plan for, train for, and intend to keep for a long time.

CAREER CLUSTERS

A career cluster is a group of occupations that are similar in nature. This course, Automotive Services 36, is a member of the transportation career cluster.

Many of the abilities developed in one career cluster may be used in jobs and careers in other career clusters. For example:

- the ability to keyboard is useful in every career cluster, not just in the business and office operations cluster
- the ability to use hand and power tools properly is useful in agribusiness, construction and fabrication, creative arts, natural resources, tourism and hospitality, and the transportation career clusters
- the ability to communicate effectively, offer assistance and service, and relate to others is important in each career cluster.

STUDENT ACTIVITIES

1. Read Chapters 3 and 7, *Working: Today and Tomorrow*, Canadian Edition, 1990.

2. Discuss and answer the following questions:

- a. Will there be a need for me to change jobs during the next five years? Give reasons for your answer.

- b. If I change jobs during the next five years:

- will I still be working within the same career cluster? Why or why not?

- will I need to upgrade my knowledge and skills and change my attitudes? Why or why not?

- c. Where could I go to obtain help with my job and career choices:

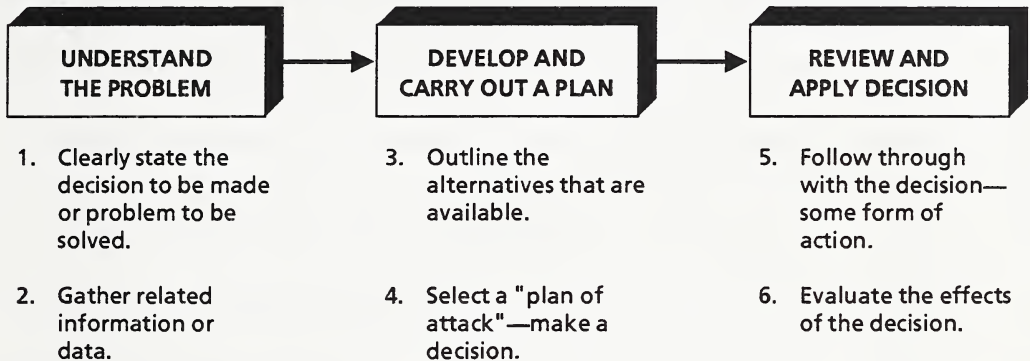
- in the school? _____

- in the community? _____

- d. What type of help is available? For example, CHOICES (a computerized career assistance program), pamphlets and booklets, resource people, occupational catalogues and occupational dictionaries.

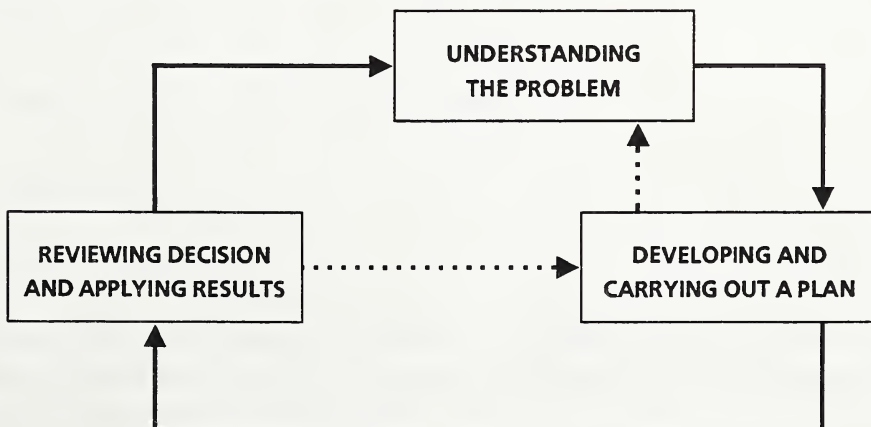
CAREER PLANNING

Career planning involves a process of making decisions. While some decisions are simple, others involve a more complex process. The six-step decision-making model used in this and your other IOP courses is shown below.



A model is a useful aid. It helps clarify the decision-making process by providing a plan or procedure for action.

Decision-making models are also used to solve problems. However, solving one problem or making a decision often leads to the need to solve other problems and make other decisions. The process, therefore, can be seen as a series of three steps, each of which affects the others. The relationship among the three parts of this process is shown in the following model.



STUDENT ACTIVITIES

1. Read Chapter 4, *Working: Today and Tomorrow*, Canadian Edition, 1990.
2. Using the decision-making process described in the textbook or the one in this workbook, identify the process that you have used or intend to use to plan your career. You may use a model to help describe your plan.

JOB SEARCH

Searching for a job is a process. If a job is part of your career plan, rather than a part-time or summer activity, it is even more important to use the proper steps in the job search process. These steps include:

1. Listing your strengths, interests, abilities, skills and work goals.
2. Clearly identifying the requirements of each job related to the career cluster.
3. Matching your strengths, interests, abilities and skills to work goals and job requirements.
4. Selecting the career cluster and then the related job.
5. Preparing your résumé in proper format.
6. Identifying job opportunities:
 - associations
 - job boards
 - making personal contacts and enquiries
 - telephone enquiries
 - cold calls
 - newspapers.
7. Preparing letters of application.
8. Follow up to applications.
9. Preparing for and participating in job interviews.
10. Obtaining a job.
11. Retaining the job.

The following job sheets provide the opportunity to update information, letters and résumés previously collected and prepared, and to use the new information in a real-life job search process; a job search that is related to your career plan.

JOB SHEET 1

IDENTIFYING JOB REQUIREMENTS

EQUIPMENT, TOOLS AND SUPPLIES

- Student workbook
- Pen or pencil

PROCEDURE

Interview a person occupied in a job that interests you, and obtain and record answers to the following questions.

Name of person interviewed: _____ Date: _____ Occupation: _____

1. What are the entry-level requirements in this occupation?

2. What technical knowledge is required?

3. What practical skills are required?

4. a. Is a driver's licence necessary? ☐ Yes ☐ No

b. If "yes" to 4a, is a defensive driving certificate required? ☐ Yes ☐ No

5. Are there any heavy lifting or other physical job requirements?

6. Would fear of heights or enclosed spaces affect employment opportunities?

7. Is shift work a requirement? If so, what are the typical shifts?

8. Are there any other special entry-level requirements of which a prospective employee should be aware? Please specify.

9. Summarize the requirements of this job.

10. Do you have the abilities needed to do this job? List areas (knowledge, skills, attitudes) that need further development.

Knowledge	Skills	Attitudes

JOB SHEET 2

PREPARING A RÉSUMÉ

EQUIPMENT, TOOLS AND SUPPLIES

- Pen
- Paper
- Keyboard and printer (word processor or typewriter)

PROCEDURE

1. Before starting to write a résumé, ask yourself what qualities, abilities and work experience information employers look for in entry-level employees in this career area.
2. Write each idea as you think of it.
3. Arrange the information in a logical order, using either of the following two sample formats: chronological résumé, biographical résumé.

SAMPLE CHRONOLOGICAL RÉSUMÉ

Any Student
1234 – 56 Street
Anytown, Alberta
T1A 2B3
Telephone: 123–4567

Position Desired: _____

Education: Currently completing Grade 12 at _____
School, Anytown, Alberta
Grades 8 and 9, _____ School, Anytown, Alberta
Will graduate 19 ____ with a Certificate of Achievement.

Work Experience: January 1986 to present -- sales assistant, Fred's Automotive Parts,
Anytown, Alberta (part-time/weekends)
September 19 ____ to June 19 ____ -- cashier, Family Restaurant, Anytown,
Alberta (evening employment)
July to August 19 ____ -- Lot attendant, City Car Sales, Anytown, Alberta
(summer employment)

Volunteer Activities: Anytown Museum tour guide

Hobbies and Interests: Swimming, skating, restoring antique cars

References: Available upon request

SAMPLE BIOGRAPHICAL RÉSUMÉ

Any Student
1234 – 56 Street
Anytown, Alberta
T1A 2B3
Telephone: 123–4567

Employment Objective: To obtain a job in which I will be able to make good use of my education, training and desire to achieve success as _____.

Education: I went to primary school in Winnipeg, Manitoba, and then moved with my family to Anytown, Alberta. I attended _____ Junior High School and am now completing a program at _____ Senior High School. I will graduate this year with a Certificate of Achievement. Courses taken relating to my career goals include:

Work Experience: I have been working part-time as a sales assistant at Fred's Automotive Parts Store. The work involved providing customer service, sales, handling cash and making change. In the evenings I have been cashiering at the Family Restaurant.

From January 19 __
to Present

During my last two summer holidays, I have worked as a part-time lot attendant at City Car Sales. This has provided me with the opportunity to develop additional skills in automotive repairs.

My hobbies include restoring antique cars, swimming and skating. When requested, I provide volunteer services at the local museum as a tour guide.

References: I will be pleased to provide references upon request.

4. Which type of résumé do you prefer? Why?

5. Which type of résumé do you think an employer prefers? Why?

6. Prepare another résumé using the format not previously used.

7. Using the following chart as a guide, evaluate your résumés.

Scale: 4 = Excellent 3 = Very Good 2 = Good 1 = Not Acceptable

Preparing a Résumé	Self-evaluation		Peer Evaluation		Teacher/Supervisor Evaluation	
	Résumé 1	Résumé 2	Résumé 1	Résumé 2	Résumé 1	Résumé 2
Was able to determine and write down own strengths, interests, abilities, skills and work experience.						
Organized information in logical order for a résumé.						
Keyboarded a clean copy of résumé in chronological and biographical format.						
Indicated a preference for one of the formats.						

JOB SHEET 3

COMPOSING A LETTER OF APPLICATION

EQUIPMENT, TOOLS AND SUPPLIES

- Pen
- Paper
- Keyboard and printer (word processor or typewriter)

PROCEDURE

Note 1: The body of the letter should consist of approximately three paragraphs.

Paragraph 1

- introduce yourself
- state why you are writing

Paragraph 2

- state briefly what you have to offer the company (knowledge, skills)

Paragraph 3

- request an interview
- give telephone number(s) of where you can be reached

Note 2: Make a minimum of three copies of the "Composing a Letter of Application" evaluation chart on page 19. Give one copy to your teacher/supervisor and one to a classmate. Keep a copy for yourself. Using the chart as a guide, have each letter evaluated.

A. Non-advertised, Non-specific Job

1. Compose a letter of application for a job. The letter should be adaptable. That is, the same letter, with just a change of address, may be used to find out whether or not a number of different companies need someone with your abilities.

The sample letter on the following page may be used as a guide.

2. See "Note 2", and evaluate "Letter A".

SAMPLE "LETTER A" OF APPLICATION

1234 – 56 Street
Anytown, Alberta
T1A 2B3
June 1, 19 ____

M ____ J. Stand
Personnel Officer
Rocket Tool Company
5678 – 90 Avenue
Anytown, Alberta
T2R 3Z4

Dear M ____ Stand:

I am interested in a position as _____ with the Rocket Tool Company.

Enclosed is a résumé outlining my education and experience. As indicated, I have skills which, I believe, would be beneficial to your organization.

I would like to discuss with you the possibility of employment with your company and will call you in a few days to see if an interview can be arranged. I will be pleased to provide references and any further information you may require. In the meantime, if you have any questions, please telephone _____.

Yours truly,

A. Student

B. Non-advertised Specific Job

1. Compose a letter of application for a job that you know may be available with a company.

The following sample letter may be used as a guide.

2. See "Note 2", and evaluate "Letter B".

SAMPLE "LETTER B" OF APPLICATION

1234 – 56 Street
Anytown, Alberta
T1A 2B3
June 1, 19 ____

M __ D. Band
Star Auto Sales
66 Broadway Avenue
Anytown, Alberta
T0T 5L4

Dear M __ Band:

I would be interested in discussing with you the possibility of employment as an order clerk with Star Auto Sales.

When I graduate, 19 ____, I will have a Certificate of Achievement with credits in automotive services and agricultural production. I believe my education and experience may qualify me for a suitable position with your company.

I would be pleased to meet you, at your convenience, to discuss possible employment, and to provide additional information you may require. You may contact me at the above address, or by telephoning _____ (after 4 p.m.).

Yours truly,

A. Student

C. Advertised Jobs

1. Scan job advertisements in the local newspaper and identify those that interest you and that match your abilities.
2. Compose a letter of application to each advertiser, citing the advertisement.

The following sample letter may be used as a guide.

3. See "Note 2", and evaluate "Letter C".

SAMPLE "LETTER C" OF APPLICATION

1234 - 56 Street
Anytown, Alberta
T1A 2B3
June 1, 19 ____

M ____ A. Trann
ABC Warehousing
21 Sunnyside Street
Anytown, Alberta
T3G 4L5

Dear M ____ Trann:

I am writing in reply to your advertisement for a _____ in the *Daily News* of May 29, 19 ____.

As you can see from the attached résumé, my education, training and past work experience correspond to the qualifications you are seeking. Your advertisement noted that you want someone with initiative and a sense of responsibility. I believe I have both of these qualities. My references, available upon request, will confirm my work ethics and skills.

I can be reached at the above address, or by telephone after 4:00 p.m. at _____.

Yours truly,

A. Student

Scale: 4 = Excellent 3 = Very Good 2 = Good 1 = Not Acceptable

Composing a Letter of Application	"Letter A"				"Letter B"				"Letter C"			
	4	3	2	1	4	3	2	1	4	3	2	1
Composed an appropriate letter of application.												
Used correct format.												
Used proper sentence structure.												
Paragraph 1 introduced yourself and stated why you were writing.												
Paragraph 2 briefly outlined what you have to offer the company.												
Paragraph 3 requested an interview and gave a telephone number where you could be reached.												
Signed the letter.												
Cleaned up the work area.												

DISCUSSION TOPICS

1. Should a résumé always be sent with a letter of application?

2. Should a letter of application be handwritten or keyboarded? Discuss the advantages/disadvantages of each method.

JOB SHEET 4

COMPLETING A JOB APPLICATION FORM

EQUIPMENT, TOOLS AND SUPPLIES

- Pen
- Paper
- Keyboard and printer (word processor or typewriter)
- Assorted application forms

PROCEDURE

Note: Before completing any application form, identify inquiries as to their appropriateness. (See "Pre-employment Inquiries", page 24.)

1. Complete the two sample application forms that follow:
 - "Sample Job Application Form" is a short form
 - "Sample Detailed Application for Employment Form" is a longer form.
2. Use these forms for practice, and then obtain application forms from companies for which you would like to work.

SAMPLE JOB APPLICATION FORM

Complete all blanks. Use CAPITAL LETTERS.

General Information

Name in full _____
Last First Middle

Address _____
Number and Street City Province Postal Code Telephone _____

Position you are applying for? _____

When can you start work? _____

Education – Most recent school first.

Name of School Attended Dates of Attendance City _____

Employment Background – Most recent job first.

Dates Name and Address of Employer Job Title and Duties _____

General

What machines or equipment can you operate? _____

What additional experience or training have you had? _____

References – Other than relatives.

Name Occupation Firm Name and Address Telephone _____

To the best of my knowledge, the above information is truthful and accurate.

Signature _____

Adapted from *The Easy-to-Read Career Planning Guide*, copyright 1986 by Alberta Career Development and Employment. Reprinted by permission.

SAMPLE DETAILED APPLICATION FOR EMPLOYMENT FORM

This application form is intended to be a sample only; it complies with the *Individual's Rights Protection Act*. It is not intended to reflect all of the information that an employer might need. It is recognized that certain employers may, for various reasons, require particular job-related information about an individual or his or her background.

(PLEASE PRINT CLEARLY)

Position applied for: _____

Name: _____ Telephone: _____ (residence)

Address: _____ (business)

(Postal Code)

Are you 18 years of age or over? _____ Yes _____ No

Are you legally entitled to work in Canada? _____ Yes _____ No

Are you willing to work in a non-smoking environment? _____ Yes _____ No

EDUCATION

School	Course of Study (List all major subjects)	Number of Years Completed	Degree or Diploma Obtained
High School			
College			
Other Institutions			

List any additional education or training of which you would like us to be aware.

EMPLOYMENT HISTORY
(Begin with Most Recent)

Company Name and Address	Position Held	From	To	Supervisor's Name	Reason for Leaving

May current employer be contacted for a reference? _____ Yes _____ No

PERSONAL INTERESTS AND ACTIVITIES (such as clubs, organizations, etc.) to which you belong.
Exclude anything with an ethnic or religious affiliation.

ADDITIONAL INFORMATION

EXPERIENCES

Give two work-related references. (Recent graduates may name a teacher or professor as one.)

1. _____ years acquainted: _____ Phone: _____
2. _____ years acquainted: _____ Phone: _____

Personal reference:

Name: _____ years acquainted: _____ Phone: _____

Note: I understand that any offer of employment may be made contingent upon a satisfactory JOB-RELATED medical examination. I declare that the statements made by me in this application form are true and complete. I understand and agree that a false statement may disqualify me from employment, or result in dismissal.

Signature: _____ Date: _____

PRE-EMPLOYMENT INQUIRIES

The inquiries given below are the types of questions frequently posed by employers to job candidates. This chart gives some examples of the inquiries that are permitted and those that are not recommended.

Subject	Permitted Inquiries	Inquiries Not Recommended
Gender, Marital Status	Availability for shift work, travel, etc.	Plans for marriage, family, child care. Inquiries specific to gender or marital status
Race, Colour, Ancestry or Place of Origin	Are you legally permitted to work in Canada?	Place of birth, citizenship status, racial origin, next of kin
Name	Name used in previous employment and/or education for purposes of reference check	Maiden name, "Christian" name or reference to origin of name
Military Service	Military service in Canada	Foreign military service (this might indicate place of origin)
Languages	Fluency in any language specifically required by a job	Other languages when not required in a specific job
Photographs		Photographs would reveal race, gender, etc.
Clubs or Organizations	Membership in professional clubs or organizations, hobbies or interests that do not reveal gender, race, religious beliefs, ancestry or place of origin	Specific inquiries about club and organization memberships that would indicate race, religious beliefs, ancestry or place of origin
Age	Are you of legal age to work in Alberta?	Specific age over 18, including retirement information
Height and Weight	Describe job duties requiring heavy lifting or other physical job requirements	Minimum/maximum height and weight requirement/stipulations
Disability	Statement that job offer is contingent upon a satisfactory job-related medical examination. Do you feel you are capable of performing the duties as outlined?	General disabilities, limitations, present or previous health problems, workers' compensation claims or absence due to stress or mental illness
Non-smoking	An employer may ask if an applicant is a non-smoker or indicate successful applicant will be required to work in a non-smoking environment	Asthmatic or permanent respiratory conditions that may be affected by smoke

JOB SHEET 5

PREPARING FOR AND PARTICIPATING IN A JOB INTERVIEW

PROCEDURE

Note: To prepare you for a variety of interview situations and questions, this procedure should be role played many times, each time with a different partner. If possible, a community partner should be asked to participate in the role play interviews.

1. Read the following notes on the purpose of the interview.

Purpose of the Interview

- a. The interview helps the prospective employee:

- find out more about the company and the job
- convince the employer of his or her suitability for the job
- decide whether or not he or she really wants the job.

- b. The interview helps the prospective employer:

- find out more about you; e.g., knowledge, skills, attitudes
- see what you can do for the company, your suitability
- judge your human relations skills
- check the information you provided in your letter of application, résumé or application form.

2. Prepare for the interview.

- a. Well before the interview date:

- find out all you can about the company; the number of employees it has, its products and services
- be confident and project the fact that you know that you have abilities that the company needs
- rehearse answering questions you think may be asked.

b. On the day of the interview:

- stay calm
- check your grooming
- dress appropriately
- arrive a little before the time set for the interview.

3. Participate in the interview. Work with one or more classmates and take turns being interviewers and interviewees:

- greet the interviewer; e.g., "good morning"
- listen to the question; if you do not understand a question, ask for it to be repeated or rephrased
- respond clearly
- ask questions about wages, benefits, etc.
- at the end of the interview, thank the interviewer.

Note: Your teacher may provide you with a list of sample interview questions.

4. After the interview:

a. Assess your performance:

- what went well?
- what did not go well?
- how could I have improved my performance?

Note: Each person acting as the interviewer should make a copy of the chart on the following page, and use it to record his or her evaluation of the person being interviewed.

b. Give the person interviewed your evaluation. Be prepared to discuss your evaluations.

5. Participate in more practice interviews:

- repeat the things you did well
- correct the things you feel could be improved
- practise, practise, practise, until you feel confident to handle almost any interview.

INTERVIEW EVALUATION CHART

Interviewer: _____ Date: _____

Interviewee: _____

Position applied for: _____

Qualities/Abilities	Key Factors	Evaluation				
		Excellent 5	4	Good 3	2	Poor 1
Appearance	Grooming Appropriate dress Poise					
Speech	Clarity Use of appropriate vocabulary Vocal quality					
Personality Traits	Friendly Outgoing Enthusiastic					
Character Traits	Ambition Manners Conscientiousness Work ethic					
Skills/Abilities (In column 2, specify key skills/abilities needed for the position.)	<ul style="list-style-type: none"> • • • • 					
Preparation	Job application/résumé Organized On time					
Participation	Proper greetings Listened Responded appropriately Asked questions					

JOB SHEET 6

IDENTIFYING EMPLOYMENT OPPORTUNITIES

EQUIPMENT, TOOLS AND SUPPLIES

- Local newspaper (classified advertisements)
- Other job advertisements
- Pen or pencil

PROCEDURE

1. Over a two-week period, review the classified and other local job advertisements. Identify employment opportunities related to the automotive industry.
2. Based on your two weeks of research, answer the following questions. Record your answers on the "Job Opportunities Analysis Chart".
 - a. How many:
 - employers are seeking apprentices?
 - job opportunities do not require an apprenticeship?
 - job opportunities specify that a journeymen certificate is required?
 - job opportunities state that experience is required? Experience is unnecessary?
 - b. When stated, what is the average minimal education level required?
3. Share and compare your chart with classmates.

JOB OPPORTUNITIES ANALYSIS CHART

Job Types:	Number of jobs for apprentices	Number of jobs that do not request or require apprenticeship	Number of jobs looking for licenced trades people	Number of jobs asking for experience and years worked	Number of jobs not requiring an experienced person	Number of jobs requiring a specific level of education (note level)
Front-end Mechanic						
Tune-up Mechanic						
Muffler Installer						
Brake System Mechanic						
Motor Mechanic Appr.						
Heavy Duty Mechanic						
Gas Bar Attendant						
Lube Attendant						
Parts Person						
Warehouse Parts						
Service Writer						
Car Prep. Person						
Car Wash Person						
Tire Repair Mechanic						
Air Condition Mechanic						
Others						
Totals:						

DISCUSSION TOPICS

1. Based on your own and your classmates research, what have you learned about present job opportunities in the automotive services industry?

2. a. What types of automotive-related jobs are presently available?

- b. What are the minimum entry-level requirements?

- c. Do you have, or will you have, these requirements by the end of Automotive Services 36?

JOB SHEET 7

INSPECTING AND SHARPENING A TWIST DRILL

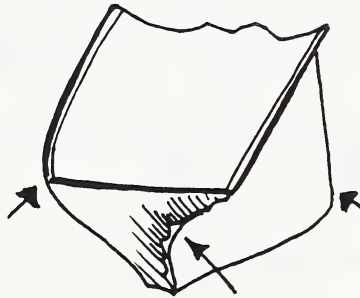
EQUIPMENT, TOOLS AND SUPPLIES

- Bench grinder
- Water pot (filled with water)
- Drill gauge
- Twist drills (worn or damaged)
- Protective clothing (e.g., coveralls, face shield)

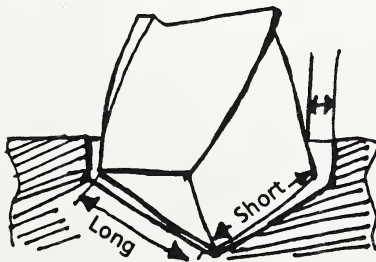
PROCEDURE

1. Inspect the twist drill for any of the following conditions:

- Dull cutting edges

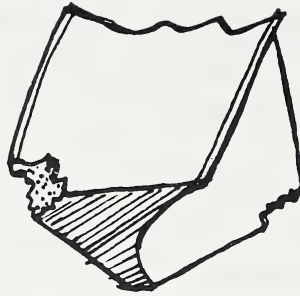


- Unequal cutting lips



Hole is larger than drill size

- Worn or broken corners



- Discolouring from overheating



2. Inspect the twist drill for improper cutting lip angles.

- a. Place the drill gauge against the twist drill, as illustrated.
- b. Look for improper angles indicated by a tapered gap between the gauge and the cutting lip

Note: Cutting lip angles may have been changed for special drilling operations.

- c. Repeat the inspection on the other cutting lip.

3. Put on the protective clothing.

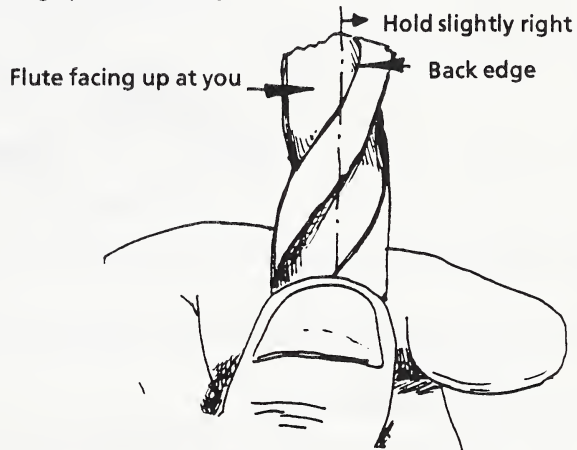
4. Unplug the bench grinder.

Note: This step is used to practise the grinding procedure. When the technique is understood, the practice steps 4 through 9 can be omitted from the procedure.

5. Grasp the drill shank with your left hand. Approximately 25 mm of the cutting end must be exposed. Your right hand is used to support the rear of the twist drill. (If you are left handed reverse the procedure.)

6. Turn the twist drill until the flute groove is facing upward.

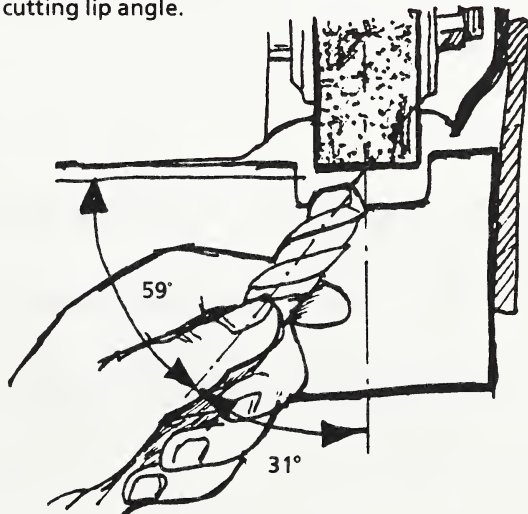
Note: This will position the cutting lips horizontally.



7. Position your left hand on the fine grit grinding wheel tool rest.

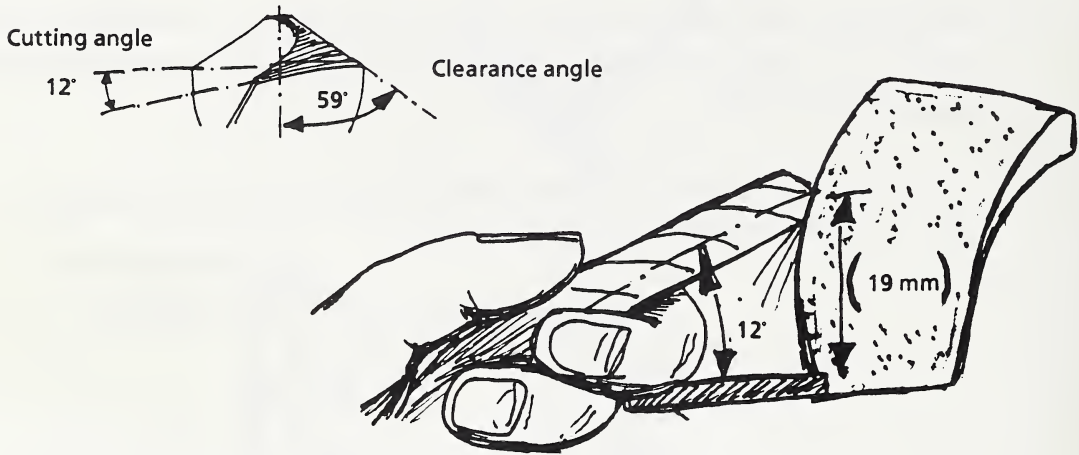
8. Align the left cutting edge of the twist drill against the grinding wheel surface.

Note: This position will form the 59° cutting lip angle.



9. Gently slide the cutting end of the twist drill upward, approximately 15 mm against the grinding wheel surface.

Note: This movement will form the 12° clearance angle.



10. When the sharpening movements can be performed accurately and smoothly, sharpen the twist drill.

Note: Hold the twist drill securely, and do not allow the cutting end to roll or slide downward during sharpening.

- Plug in the grinder power cord.
 - Turn on the grinder power switch, and allow it to reach full operating speed.
 - Position the twist drill correctly.
 - Lightly slide the cutting end of the twist drill against the grinder face, twice.
 - Dip the cutting end of the twist drill into the water pot to cool it.
 - Turn the twist drill one half revolution, and grind the other cutting lip for two passes.
 - Cool the twist drill in the water pot.
 - Continue to sharpen both cutting lips with an equal number of passes, until the twist drill is sharpened.
11. Inspect the twist drill for any remaining wear, damage or improper angles. Grind as necessary to correct these problems.
- Safety Note:** Do not exert excessive pressure on the grinding wheel.
12. Clean and return all equipment, tools and supplies to their proper storage areas.
13. Clean up the work area.

12. Using the following chart as a guide, evaluate your performance.

Inspecting and Sharpening a Twist Drill	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
The twist drill angles were correct.				
No wear or damage to the cutting lips was visible.				
The cutting lip angles were accurate $\pm 1^\circ$.				
The clearance angle was accurate $\pm 1^\circ$.				
The cutting lips were not discoloured.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why are twist drills sharpened instead of thrown away?

2. What special drilling operations require cutting angle changes?

3. Why is the twist drill frequently cooled during sharpening?

4. Why are an equal number of sharpening passes used for both cutting lips?

5. What could cause each of the following problems?

● Dull cutting edges: _____

● Unequal cutting lips: _____

● Worn or broken corners: _____

● Discolouring from overheating: _____

JOB SHEET 8

INSPECTING AND REPAIRING A CHISEL

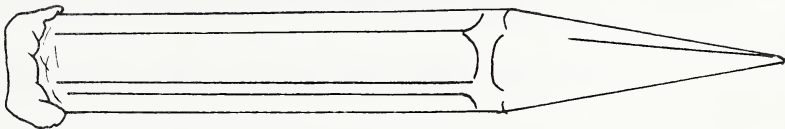
EQUIPMENT, TOOLS AND SUPPLIES

- Bench grinder
- Water pot (filled with water)
- Oxyacetylene welding unit
- Quench tank (filled with water)
- Lock grip pliers
- Emery cloth (coarse grit)
- Chisel (dulled or damaged)
- Protractor
- Tool rest
- Protective clothing (e.g., face shield, welding gloves)

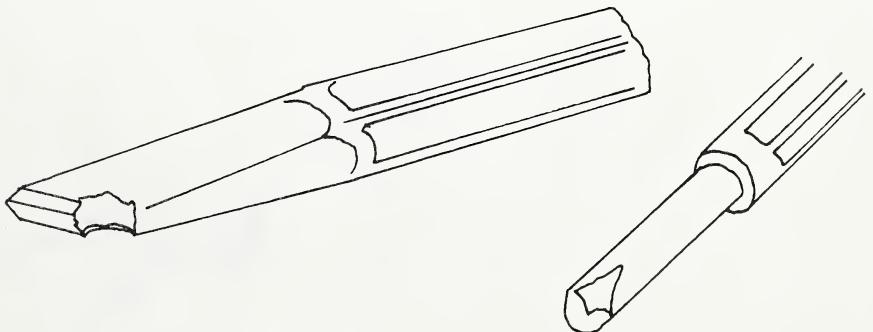
PROCEDURE

1. Inspect the chisel for any of the following problems:

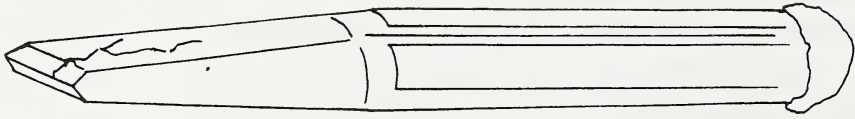
- Head mushrooming



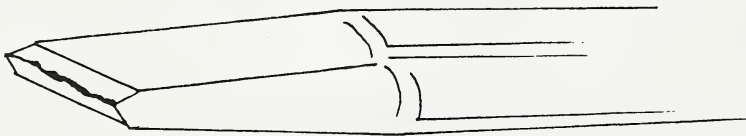
- Corner chipping



- End cracking

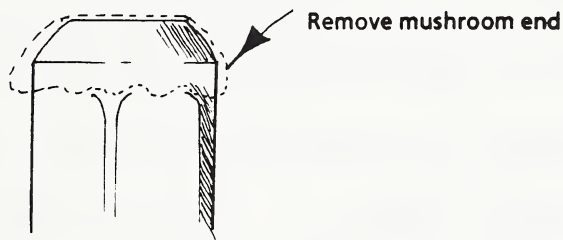


- Cutting edge dulling or flattening



2. Inspect the cutting edge for the correct cutting edge angle.

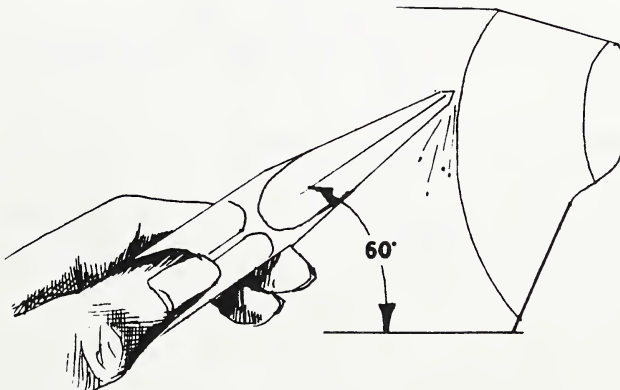
3. Put on the protective clothing.
 4. Turn on the grinder power switch, and allow the wheel to reach full speed before proceeding.
 5. Pick up the chisel and hold securely in both hands.
 6. Place the chisel head end on the grinder tool rest.
 7. Lightly grind a 60° chamfer on the corner of the chisel head to remove any mushrooming.
- Note:** Frequently quench the head end of the chisel, to prevent the chisel from overheating.



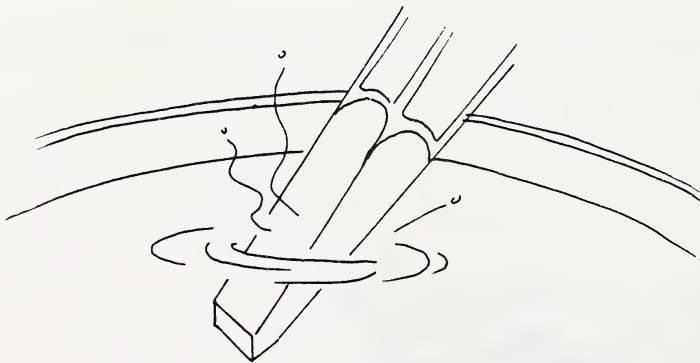
Safety

Note: Do not exert excessive pressure on the grinding wheel.

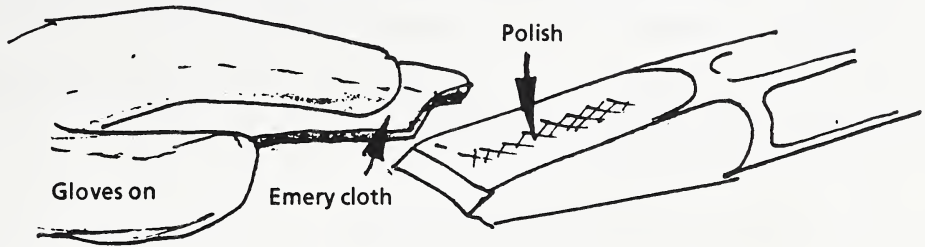
8. Turn off the grinder power switch, and wait for the wheel to stop turning.
9. Adjust the tool rest upward, and at an angle to support the chisel cutting lip at a 60° angle to the grinding wheel.



10. Turn on the grinder power switch, and allow the wheel to reach full speed before proceeding.
11. Lie the chisel on the tool rest, and sharpen one side of the cutting edge.
12. Quench the cutting end of the chisel in the water pot.
13. Sharpen and quench the other side of the chisel cutting edge.
14. Inspect the chisel for any remaining problems or improper angles, and grind as necessary.
15. Put on the welding goggles.
16. Securely clamp the centre of the chisel with the lock grip pliers.
17. Light the welding torch and adjust to a neutral flame.
18. Slowly heat the chisel to a cherry red colour throughout its length.
19. Shut off the welding torch.
20. Quickly immerse the initial 25 mm of the chisel's cutting edge in the quench tank. Hold the chisel end under water until the wet section turns a dark colour.

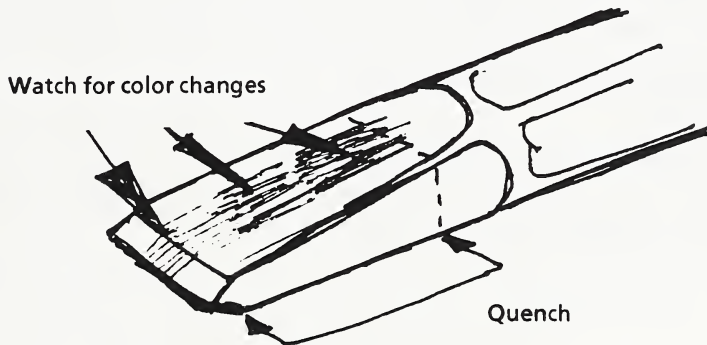


21. Polish the flat sides of the cutting edge with the emery cloth.



22. Watch for the shiny section of the chisel to change colour.

Note: The surface will turn yellow, then brown, and finally purple.



23. As soon as the chisel surface turns purple, cool the entire chisel in the quench tank.

Note: If the body of the chisel remains red while the cutting end turns purple, the material was overheated and the tempering process must be repeated.

24. Clean and return all equipment, tools and supplies to their proper storage areas.

25. Clean up the work area.

26. Using the following chart as a guide, evaluate your performance.

Inspecting and Repairing a Chisel	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
The cutting edges were at the correct angle.				
The cutting edges were of equal size and angle.				
The chisel was chamfered correctly.				
The chisel was tempered properly.				
The chisel cut clearly and without excessive cutting edge damage.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Can tempering a chisel cause damage to metal?

2. What other tools should be tempered before use?

3. What automotive parts require heat treating?

4. What could cause the following problems?

● Head mushrooming: _____

● Corner chipping: _____

● End cracking: _____

● Cutting edge dulling or flattening: _____

JOB SHEET 9

INSPECTING, MAINTAINING AND REPAIRING SHOP EQUIPMENT

EQUIPMENT, TOOLS AND SUPPLIES

- Operator's manual for equipment
- Pen or pencil
- Tools (as required)
- Cleaning supplies (as required)
- Rags
- Protective clothing (e.g., safety glasses)
- Lubricants (as required)

PROCEDURE

Note: This job sheet provides general instructions. Refer to the appropriate operator's manual for specific details throughout this task.

1. With your teacher's/supervisor's permission, select an appropriate item of shop equipment.
2. Identify the major components of the equipment item.
Note: The operator's manual should have a diagram for this purpose.
3. Identify the items that require regular maintenance and inspection.
4. Put on the protective clothing.
5. Inspect the equipment and report any damage or required repairs to your teacher/supervisor.
6. Adjust and lubricate the parts where necessary, as directed by the operator's manual.
7. With your teacher's/supervisor's permission, repair the equipment as directed.
8. Thoroughly clean the equipment, and all related components.
9. Clean and return all equipment, tools and supplies to their proper storage areas.
10. Clean up the work area.

11. Using the following chart as a guide, evaluate your performance.

Inspecting, Maintaining and Repairing Shop Equipment	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
The equipment was properly adjusted.				
All problems were noted and reported.				
All repairs were completed.				
The unit and related components were cleaned.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why are periodic inspections, maintenance and repairs necessary in an automotive repair shop?

2. Why is cleaning important to equipment life?

3. What would you do if the operator's manual for the equipment to be inspected, maintained or repaired was missing?

JOB SHEET 10

PERFORMING TOOL ROOM DUTIES

EQUIPMENT, TOOLS AND SUPPLIES

- Tool room (stocked with required equipment and tools)
- Pen or pencil
- Clipboard

PROCEDURE

Note: This general procedure may be changed to suit the particular tool control system used in the school lab or workplace.

1. Unlock the tool room door.

Note: Assigned students only are allowed in the tool room during this task.

2. Inspect the tool room and the inventory and report any missing or damaged items to the teacher/supervisor.

3. Date a copy of the "Tool Sign-out Sheet".

4. Place the "Tool Sign-out Sheet" on the clipboard.

5. Position the clipboard at the tool room door or sign-out wicket.

6. When someone requires an item, use the following procedure.

- a. Have the person print the name of the item required, and his or her own name.

Note: A student cannot sign out or return items for other people.

- b. Obtain the item.

- c. Inspect the item for damage.

Note: Do not issue a damaged item.

- d. Check that the correct information was written on the "Tool Sign-out Sheet", then issue the item.



7. When an item is returned, use the following procedure.
 - a. Check that the proper person is returning the item.
 - b. Check that the item is not damaged or dirty.

Note 1: A damaged item should not be accepted until the teacher/supervisor has been notified of the damage.

Note 2: A dirty item must be cleaned by the user before returning it to the tool room.
 - c. Check the item for minor problems and then record the problems in the condition section of the "Tool Sign-out Sheet".
 - d. Accept an item into the tool room by initialling the returned section.
 - e. Place each item in its proper storage location.
8. During time periods when items are not being requested or returned, perform the following duties:
 - clean up the tool room area
 - perform minor adjustments and repairs on items.
9. Before locking the tool room door at the end of your shift, ensure that:
 - all items are cleaned and returned to their proper storage location
 - the tool room area is clean
 - the "Tool Sign-out Sheet" indicates that all items are returned.
10. Lock the tool room door.
11. Initial the "Tool Sign-out Sheet" and give it to the teacher/supervisor.
12. Clean and return all equipment, tools and supplies to their proper storage areas.
13. Clean up the work area.

12. Using the following chart as a guide, evaluate your performance.

Performing Tool Room Duties	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Assigned persons only were permitted in the tool room.				
All items were returned to their proper location.				
All damaged items were reported before storage.				
All items were cleaned before storage.				
The "Tool Sign-out Sheet" was completed properly.				
The tool room was clean and organized.				
All minor repairs were completed.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Which tool room responsibilities are most difficult to perform?

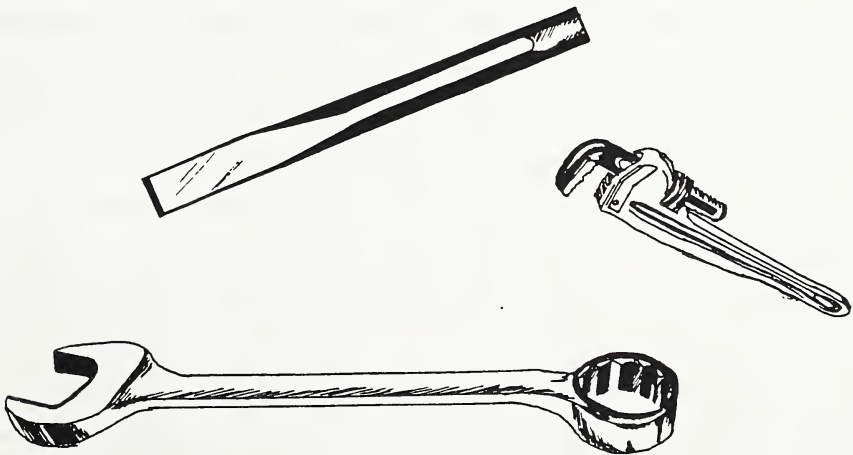
2. How can tool users make the tool room person's duties easier to perform?

3. What is a tool kit and how is it used?

4. What are the advantages and disadvantages of your current tool room control system?

Advantages

Disadvantages



TOOL SIGN-OUT SHEET

Date: _____ Tool Room Attendant: _____

Note: All information must be neatly printed.

[illegible]

JOB SHEET 11

TAKING A TOOL ROOM INVENTORY

EQUIPMENT, TOOLS AND SUPPLIES

- Pen or pencil

PROCEDURE

1. Make copies of the following charts and record the inventory of items in the school lab or workplace tool room. Use catalogues to help you identify product names, manufacturers, parts numbers and sizes.

Automotive Supplies				
Item No.	Item Name	Manufacturer	Part Number/Size	Stock Count
Sample	Power Suds Soap	Qwik-Kleen Ltd.	1201 – 10 litre	3
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Automotive Equipment					
Item No.	Item Name	Manufacturer	Model	Serial Number	Stock Count
Sample	Tire Changer	Coates	RC10-A	156374	1
1					
2					
3					
4					
5					

Automotive Hand Tools				
Item No.	Item Name	Manufacturer	Part Number/Size	Stock Count
Sample	Wrench	Handi-Tool	431 – 14 mm	5
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

2. Using the following chart as a guide, evaluate your performance.

Taking a Tool Room Inventory	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
All items were recorded for inventory				
Used catalogues to properly identify product names, manufacturers, parts numbers and sizes.				
Form was legible.				

DISCUSSION TOPICS

1. Why are inventories required?

2. What types of inventories are done in automotive repair shops?

3. How often are inventories done in automotive repair shops?



JOB SHEET 12

PERFORMING PARTS ROOM DUTIES

EQUIPMENT, TOOLS AND SUPPLIES

- Pen or pencil

PROCEDURE

Note: The duties performed during this job sheet will depend upon the established system of parts management in the school or workplace.

1. Perform as many of the following duties as possible during a one week period.
 - Maintain inventory forms and quantities.
 - Obtain and supply parts orders.
 - Receive and prepare parts orders for shipping.
 - Pick up and deliver parts orders.
 - Read current parts information updates or bulletins.
 - Determine parts numbers and delivery time lines.
 - Clean and maintain a safe work area.
2. At the end of each daily shift, record the required information on the "Personal Log Sheet".

Note: Make additional copies of the log sheet, as required.

PERSONAL LOG SHEET

Name: _____

Workplace Name: _____

Date	Time In	Time Out	Duties Performed

3. a. Make copies of the following chart.
- b. Using the chart as a guide, evaluate your performance each day.

Performing Parts Room Duties Date: _____	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
All duties assigned were satisfactorily completed.				
All forms were accurately and legibly filled out.				
Parts numbers were identified quickly and accurately.				
A professional attitude was displayed at all times.				
The work area was clean and safe.				
Safety procedures were followed.				
The log sheet was completed.				

DISCUSSION TOPICS

1. Why are accurate records important for parts rooms?

2. Why is knowledge of manufacturers' names for parts important to a parts person?

3. What are the most important duties of a parts person?

4. What were the most important things learned from performing parts room duties?

5. Why may several prices be listed for the same part?

6. What do the following terms mean?

- Back order:

- Serial number:

- Bus bill:

- Purchase order:

7. What career options are available for people interested in the automotive parts or tool supply industry?

JOB SHEET 13

IDENTIFYING VEHICLE PARTS

EQUIPMENT, TOOLS AND SUPPLIES

- Pen or pencil
- Vehicles (three different manufacturers)
- Service manuals (related to available vehicles)
- Automotive textbooks
- Trouble light
- Inspection mirror
- Creeper
- Floor jack
- Safety stands
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

1. Put on the protective clothing.
2. Safely raise and support each vehicle as required for the task.
3. Identify and check off each component listed on the following checklist as it is identified on each vehicle.

Note: If the vehicle does not have a component, then print N/A (not applicable) in the appropriate space.

VEHICLE PARTS CHECKLIST

Part Name	Vehicle 1	Vehicle 2	Vehicle 3
BODY			
Hood			
Left rear door			
Rear bumper			
Right kick panel			
Right doorpost			
Left rocker sill			
Headlight bezel			
Rain gutter			
Grill			
Right door hinge			
Door drain hole			

Part Name	Vehicle 1	Vehicle 2	Vehicle 3
SUSPENSION			
Right front coil spring			
Left rear leaf spring			
Right lower control arm			
Grease nipples			
Frame			
Right rear shock absorber			
Left front McPherson strut			
STEERING			
Steering box			
Rack and pinion			
Power steering pump			
Power steering pressure hose			
Left idler arm			
Upper right ball joint			
Right inner tie rod end			
Pitman arm			
Centre link			
ENGINE MECHANICAL			
Engine block			
Cylinder head			
Crankshaft pulley			
Valve cover			
Head bolts			
Harmonic balancer			
Timing marks			
Motor mounts			
COOLING			
Coolant			
Coolant overflow tank			
Radiator cap			
Water pump			
Heater hose			
Lower radiator hose			
Thermostat housing			
Radiator			
Fan shroud			
Vee belts			
Serpentine belt			
Idler pulley			
Fan			
Temperature sending unit			

Part Name	Vehicle 1	Vehicle 2	Vehicle 3
LUBRICATION			
Oil filter			
Oil dipstick			
Oil pan			
Oil drain plug			
Oil filler cap			
Oil change sticker			
Oil pressure sending unit			
FUEL SYSTEM			
Fuel tank			
Fuel lines			
Fuel hoses			
Fuel pump			
Fuel filter			
Injection pump			
Injectors			
Carburetor			
Air filter			
Air filter housing			
Air horn gasket			
Intake manifold			
Heat riser valve			
EGR (Exhaust Gas Recirculation) valve			
Charcoal canister			
PCV (Positive Crankcase Ventilation) valve			
EXHAUST SYSTEM			
Exhaust manifold			
Resonator			
Muffler			
Tail pipe			
Exhaust hangers			
Catalytic converter			
IGNITION			
Spark plugs			
Spark plug wires			
Distributor cap			
Rotor			
Ignition module			
Coil distributor shaft			
Primary wiring connection			

Part Name	Vehicle 1	Vehicle 2	Vehicle 3
ELECTRICAL			
Battery			
Ground cable			
Alternator			
Voltage regulator			
Left high beam			
Rear right marker light			
Starter			
Starter solenoid			
Wiring harness			
Fuse box			
Electronic analyzer connector(s)			
DRIVE TRAIN			
Transmission			
Transmission dipstick			
Transmission level plug			
Transmission rear mount			
Transmission linkage			
Bell housing			
Clutch linkage			
Rear extension housing			
Drive shaft			
Constant velocity joints			
Front yoke			
Rear universal joint			
Centre bearing			
Slip yoke			
Rear axle housing			
Front pinion seal			
Differential cover			
Rear axle housing level plug			
Rear axle studs			
Transfer case			
BRAKES			
Master cylinder			
Power booster			
Disc brake unit			
Drum brake unit			
Right front brake hose			
Rear brake hose			
Left rear backing plate			
Right rear wheel cylinder			
Left front caliper			
Brake lines			
Emergency brake cable			

4. Remove each vehicle from the safety stands.
5. Carefully return each vehicle to its proper storage area.
6. Lock each vehicle and return the keys to the teacher/supervisor.
7. Clean and return all equipment, tools and supplies to their proper storage areas.
8. Clean up the work area.
9. Using the following chart as a guide, evaluate your performance.

Identifying Vehicle Parts	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All parts were identified correctly.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why is it important to be able to identify parts used on a variety of vehicles, if you are working at a dealership?

2. Do all manufacturers use the same part names? Why or why not?

JOB SHEET 14

DETAILING A VEHICLE

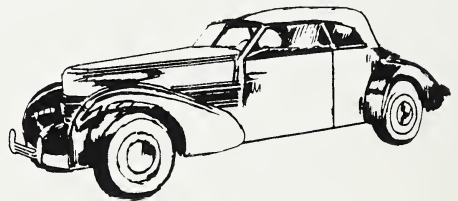
EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Vehicle operator's manual
- Wash bay
- Water supply (hot and cold)
- Pressure washer
- Pails
- Garbage can
- Car wash brush
- Vacuum cleaner and attachments
- Vinyl cleaner
- Power polisher
- Window cleaner
- Tire cleaner
- Car wash soap
- Car wax
- Chamois
- Rags
- Protective clothing (e.g., coveralls, safety glasses)

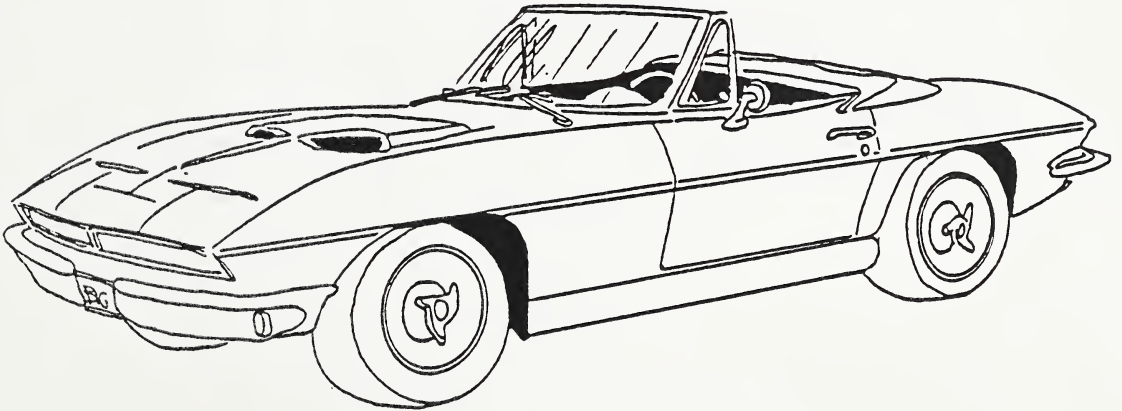
PROCEDURE

1. Park the vehicle in the wash bay and turn off the ignition.
2. Close the windows and sunroof.
3. Put on the protective clothing.
4. Remove the floor mats and position them for cleaning.
5. Clean the interior.
 - a. Empty, clean and reinstall the ashtrays.
 - b. Clean the vinyl surfaces.
 - c. Clean the inside of the windows.
 - d. Vacuum the upholstery and rugs.
 - e. Shampoo the carpets.
 - f. Apply vinyl dressing to vinyl surfaces.
 - g. Clean and reinstall the floor mats.
6. Clean and organize the trunk.

Note: Reinstall the spare tire and jack according to the instructions in the operator's manual.
7. Scrub the tires with tire cleaner.



8. Wash the exterior of the vehicle with the pressure washer.
9. Rinse the vehicle with cool water.
10. Chamois the vehicle dry.
11. Apply and polish the vehicle wax according to the wax manufacturer's instructions on the container.
12. Return the vehicle to the proper parking area.
13. Clean and return all equipment, tools and supplies to their proper storage areas.
14. Clean up the work area.



15. Using the following chart as a guide, evaluate your performance.

Detailing a Vehicle	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
The interior of the vehicle was cleaned.				
The windows were cleaned.				
The exterior of the vehicle was cleaned.				
The trunk was cleaned and organized.				
The wax was properly applied and polished.				
The vehicle's appearance was suitable for sale on a sales lot.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why are new vehicles cleaned prior to delivery to the customer?

2. How will proper detailing affect the appearance of the vehicle over a long period of time?

3. What other detailing tasks can be performed on used vehicles to improve their appearance?

4. How can upholstery be cleaned?

JOB SHEET 15

INSPECTING A VEHICLE BODY

EQUIPMENT, TOOLS AND SUPPLIES

- Pen or pencil
- Trouble light
- Inspection mirror
- Creeper
- Floor jack
- Safety stands
- Vehicle(s)
- Protective clothing (e.g., coveralls, safety glasses)



PROCEDURE

Safety Note: Appropriate protective clothing must be worn throughout this procedure.

1. Park the vehicle on a flat, level area with ample viewing space on all sides. Turn off the ignition.
2. Record the date, vehicle description and odometer reading on the "Vehicle Body Inspection Report", pages 70 to 72.

3. Inspect the vehicle according to the statements on the "Vehicle Body Inspection Report".

Safety Note: Safely raise, support and lower the vehicle as required.

4. Record your findings on your report.
5. Park the vehicle in the proper storage area.
6. Lock the vehicle.
7. Give the keys and body inspection report to the teacher/supervisor.
8. Clean and return all equipment, tools and supplies to their proper storage areas.
9. Clean up the work area.

10. Using the following chart as a guide, evaluate your performance.

Inspecting a Vehicle Body	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
All steps in the procedure were completed.				
All problems were noted on the report.				
All safety concerns were noted.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. When should the body of a vehicle be inspected?

2. What problems can be avoided by performing a body inspection?

3. How can accident damage be detected after repairs are made?

VEHICLE BODY INSPECTION REPORT

Date: _____

Vehicle Description:

Make _____

Model _____

Year _____

Colour _____

Licence Number _____

Serial Number _____

Odometer Reading: _____ (km/m)

INSPECTION AREAS		Acceptable	Not Acceptable
DOORS			
● Fit	(equal gap on both sides, flush with adjacent body panels)		
● Latching	(latches when closed with minimal force)		
● Hinge wear	(no clearance felt when lifting on outer, lower edge of open door)		
● Locking	(locks work properly with power assist or door key)		
● Drain holes clear	(not plugged with rust, dirt or debris)		

INSPECTION AREAS	Acceptable	Not Acceptable
TRUNK <ul style="list-style-type: none"> ● Fit ● Latching ● Locking 		
HOOD <ul style="list-style-type: none"> ● Fit ● Latching ● Locking ● Rubber stop condition (not damaged or worn) 		
OTHER BODY PANELS <ul style="list-style-type: none"> ● Alignment (straight when viewed from end, no ripples) ● Rust or damage (none visible) ● Damage repairs (none visible when viewed from interior surfaces such as trunk) ● Rain gutters (straight) 		
BODY MOUNT <ul style="list-style-type: none"> ● Looseness (tight fasteners) ● Wear (none visible) ● Damage (none visible) 		
EXTERIOR TRIM AND OTHER FEATURES <ul style="list-style-type: none"> ● Secure (not loose or missing) ● Damage (not cracked, bent or scratched) ● Operation (accessories; e.g., power mirrors work) 		
EXTERIOR FINISH <ul style="list-style-type: none"> ● Paint (not faded, damaged or rusted through) ● Vinyl (not faded, damaged or loose) 		

INSPECTION AREAS		Acceptable	Not Acceptable
WINDOWS <ul style="list-style-type: none"> ● Condition (not pitted, cracked or damaged) ● Sealing (no evidence of leaking) ● Operation (smooth movement) 			
FLOORS <ul style="list-style-type: none"> ● Condition (no excessive rusting under passenger compartment or trunk) 			
INTERIOR <ul style="list-style-type: none"> ● Vinyl (not faded or warped, no cracks, looseness or missing components visible) ● Fabric (not faded, torn, stained or damaged) ● Features (all features operational and in acceptable condition) 			
GENERAL <ul style="list-style-type: none"> ● Alignment (body appears straight when viewed from five meters in front and rear of the vehicle) ● Appearance (body appears to be well maintained) ● Lights (all lights operate properly and lenses are undamaged) 			

Comments and Listing of Safety Concerns with Vehicle

JOB SHEET 16

INSPECTING A VEHICLE FRAME

EQUIPMENT, TOOLS AND SUPPLIES

- Pen or pencil
- Vehicle with a frame
- Trouble light
- Hoist
- Scraper
- Rags
- Broom
- Protective clothing (e.g., coveralls, safety glasses)
- Water hose/water supply

PROCEDURE

1. Park the vehicle on, or over, the hoist as directed by your teacher/supervisor. Turn off the ignition.
2. Adjust the hoist as required, then raise the vehicle to full working height and put on the safety lock.
3. Turn on the trouble light.
4. Put on the protective clothing.
5. Clean off dirt and debris from the frame. Use a scraper where necessary.
6. Inspect the frame for the following problems:
 - loose fasteners
 - bends or cracks
 - improper repairs.

Note: Watch for burnt paint, flat areas of fresh undercoat and surfaces where the paint coat has popped off.
7. Report any frame problems to the teacher/supervisor.

8. Sweep up dirt and debris on the work area floor.
9. Lower the vehicle.
10. Park the vehicle in the proper storage area.
11. Lock the vehicle.
12. Return the keys to the teacher/supervisor.
13. Clean and return all equipment, tools and supplies to their proper storage areas.
14. Clean up the work area, wash down the hoist and floor as necessary.
15. Using the following chart as a guide, evaluate your performance.

Inspecting a Vehicle Frame	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
All steps in the procedure were completed.				
The vehicle was properly suspended on the hoist.				
All frame problems were noted and reported.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. How can frames become damaged?

2. How can frame damage be repaired?

3. When should frames be inspected?

4. What inspections should be made to the underside of a unibody vehicle?

5. How does the unibody support the vehicle?

JOB SHEET 17

INSPECTING THE BALL JOINTS

EQUIPMENT, TOOLS AND SUPPLIES

- Pen or pencil
- Paper
- Appropriate repair manual
- Trouble light
- Creeper
- Pry bar
- Floor jack
- Ball joint checking gauge
- Vehicle (front coil springs between control arms)
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

Note 1: Vehicles with the coil spring mounted on the upper control arm require additional steps to inspect the ball joints. Ask your teacher/supervisor for additional information when inspecting these vehicles.

Note 2: Ball joint inspection is a common step in a vehicle suspension check.

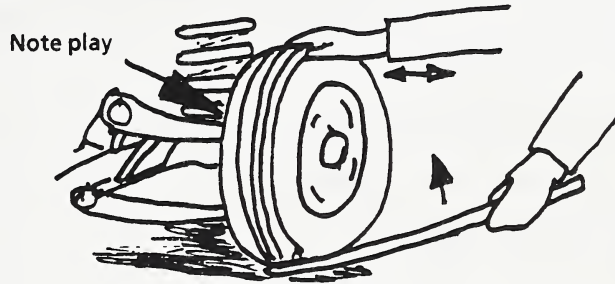
Note 3: A classmate is needed as a helper for part of this job sheet.

Note 4: Consult the appropriate repair manual before starting this procedure.

1. Park the vehicle on a flat floor surface and turn off the ignition.
2. Put on the protective clothing.
3. Position the floor jack saddle under the lower control arm just inward of the lower ball joint.
Safety Note: The saddle must not contact the ball joint, or damage may result.
4. Lift up the control arm until the jounce rubber bumper moves away from the frame.
5. Clamp the anchor end of the ball joint checking gauge to the lower control arm.
6. Position and lock the gauge plunger on top of the ball joint stud.

Note: The plunger must be preloaded 10 mm.

7. Set the gauge face to align with the 0 mark and pointer.
8. Have a classmate position a pry bar under the bottom of the tire and firmly lift the tire up and down several times.



9. Read the lower ball joint movement on the gauge.
10. Record the lower ball joint movement.
11. Repeat the procedure for the upper ball joint movement.
12. Record the upper ball joint movement.
13. Lower the vehicle to the floor.
14. Clean and return all equipment, tools and supplies to their proper storage areas.
15. Clean up the work area.
16. Using the repair manual, determine the specifications for ball joint wear.
17. Compare the ball joint measurements to the specifications.
18. Report excessive ball joint wear to the teacher/supervisor.

19. Using the following chart as a guide, evaluate your performance.

Inspecting the Ball Joints	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
The saddle was positioned correctly.				
The measurements were accurate.				
The proper specifications were selected.				
All excessive wear was reported.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

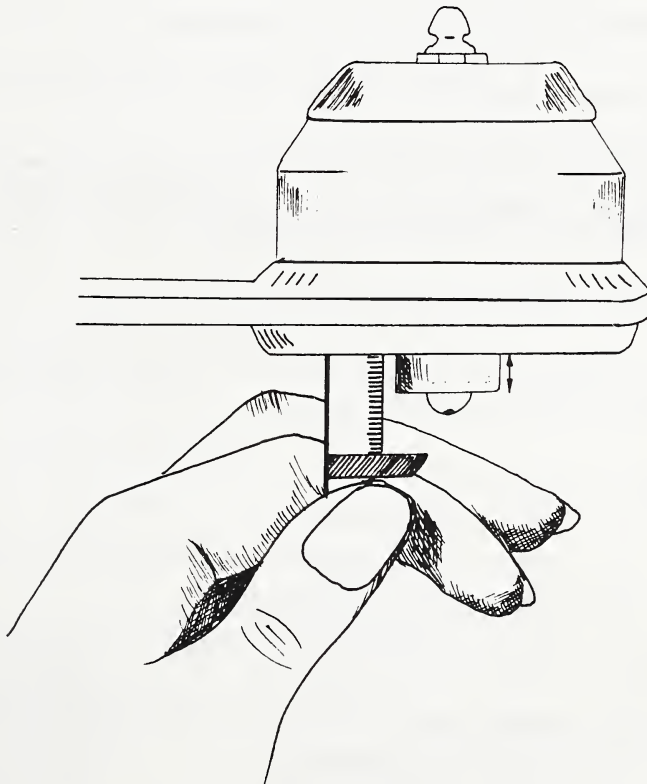
1. What hazards are associated with ball joint wear?

2. How are ball joints replaced?

3. How are ball joint wear indicators measured?

4. What changes in procedure are required if the spring is located on the upper control arm?

5. What changes in procedure are required if a strut replaces the upper control arm?

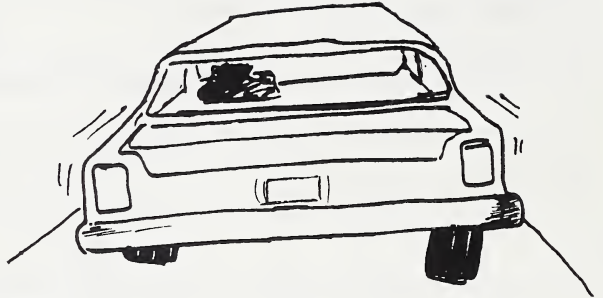


JOB SHEET 18

INSPECTING THE SPRINGS

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Trouble light
- Creeper
- Floor jack
- Safety stands
- Inspection mirror
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil
- Notepad/inspection checklist



PROCEDURE

1. Park the vehicle on a flat surface and turn off the ignition.
2. Put on the protective clothing.
3. Visually inspect the vehicle to determine if any side or corner of the vehicle is tipped downward.
Note: Your teacher/supervisor may require a suspension height check and/or frame angle check according to the manufacturer's instructions.
4. Raise and safely support the vehicle off the floor.
5. Inspect the front and rear springs for any of the following problems. Record each problem identified, on a notepad or inspection checklist.

- Coil Springs:
- broken coils
 - coils turned out of position
 - rocks in the spring saddles
 - loose or missing spring clamps
 - worn or damaged spring insulators

- Leaf Springs:
- broken leaves
 - worn or damaged bushings
 - broken centre bolts
 - loose attachment bolts

- Torsion Bars:**
- broken or damaged bars
 - metal fatigue marks on bar surface
 - damaged adjusting bolts or arms
 - worn bar ends or sockets
 - worn bushings

- Lower the vehicle.
- Report any spring problems to your teacher/supervisor.
- Return the vehicle to the proper parking area.
- Clean and return all equipment, tools and supplies to their proper storage areas.
- Clean up the work area.
- Using the following chart as a guide, evaluate your performance.

Inspecting the Springs	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All spring problems were reported.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

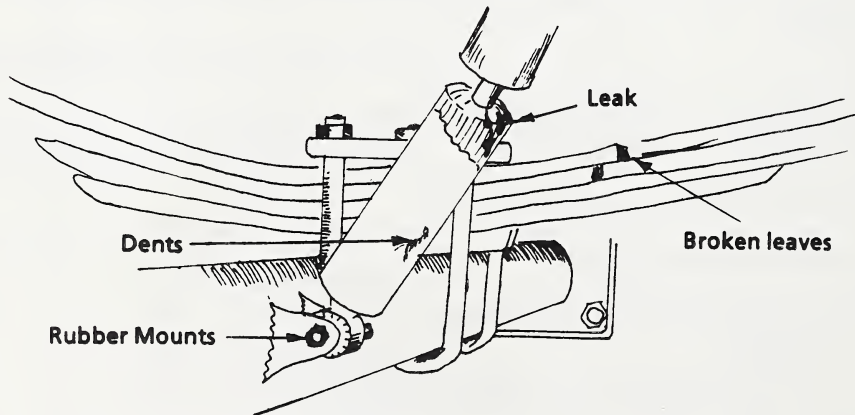
DISCUSSION TOPICS

1. What could happen if a spring broke while the vehicle was in motion?

2. What causes spring sag?

3. Do all shock absorbers support the vehicle weight?

4. What other types of springs have been used in automotive suspension systems?



JOB SHEET 19

INSPECTING THE SHOCK ABSORBERS

EQUIPMENT, TOOL AND SUPPLIES

- Creeper
- Trouble light
- Inspection mirror
- Vehicle
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil
- Notepad/inspection checklist

PROCEDURE

1. Park the vehicle on a flat surface and turn off the ignition.
2. Put on the protective clothing.
3. Bounce the vehicle on each corner, and observe the number of bounces required to control the movement.

Note: The shock absorber should allow one free bounce, and then stabilize the vehicle to prevent further movement.

4. a. Visually inspect the shock absorbers for any of the following problems:
 - oil leakage
 - housing dents
 - broken or bent shafts
 - worn or damaged bushings
 - loose or missing attachment fasteners.
- b. Record your findings on a notepad or inspection checklist.
5. Report all shock absorber problems to your teacher/supervisor.
6. Clean and return all equipment, tools and supplies to their proper storage areas.
7. Clean up the work area.

8. Using the following chart as a guide, evaluate your performance.

Inspecting the Shock Absorbers	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All shock absorber problems were recorded and reported.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area				

DISCUSSION TOPICS

1. How could defective shock absorbers affect the vehicle's operation?

2. What are the advantages and disadvantages of gas-filled shock absorbers?

3. What are the advantages and disadvantages of adjustable air shock absorbers?

4. What is the normal service life of shock absorbers?

5. What are the differences between shock absorbers and struts?

JOB SHEET 20

INSPECTING THE CONTROL ARM BUSHINGS

EQUIPMENT, TOOLS AND SUPPLIES

- Trouble light
- Inspection mirror
- Vehicle
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil
- Notepad/inspection checklist
- Hoist

PROCEDURE

1. Park the vehicle on the hoist and turn off the ignition.
2. Put on the protective clothing.
3.
 - a. Inspect the bushings on all control arms for any of the following conditions:
 - heavy cracking
 - wear (movement is visible when vehicle bounces)
 - distortion (cross shaft is off centre).
 - b. Record your observations on a notepad or inspection checklist
4. Report bushing problems to your teacher/supervisor.
5. Clean and return all equipment, tools and supplies to their proper storage areas.
6. Clean up the work area.

7. Using the following chart as a guide, evaluate your performance.

Inspecting the Control Arm Bushings	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All bushing problems were recorded and reported.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What are wheel alignment angles?

2. How can damaged or worn control arm bushings affect vehicle handling and operation?

3. What is the procedure for replacing control arm bushings?

JOB SHEET 21

INSPECTING THE TIRES

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Tire gauge
- Compressed air supply
- Tire chuck
- Protective clothing (e.g., coveralls)

PROCEDURE

Note: Include all road wheels and the spare tire when inspecting tires on a vehicle.

1. Park the vehicle on a level surface and turn off the ignition.
2. Inspect the tire pressure information decal to determine the proper tire sizes and inflation pressures for the vehicle.
3. Put on protective clothing.
4. Inspect the tires to verify that the tire sizes are correct.
5. Inspect the tire treads to identify abnormal wear patterns.
6. Check the tire inflation to identify improperly inflated tires.
7. Adjust each tire to the specified pressure.
8. Return the vehicle to the proper parking area.
9. Ensure windows are rolled up and doors are locked.
10. Report tire problems to your teacher/supervisor.
11. Clean and return all equipment, tools and supplies to their proper storage areas.

12. Clean up the work area.
13. Using the following chart as a guide, evaluate your performance.

Inspecting the Tires	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Tire codes were interpreted correctly.				
Tire inflation specifications were identified.				
Tire pressures were adjusted properly.				
All tire problems were properly identified and reported.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why is proper tire inflation important?
- _____
- _____
2. What types of problems can cause tire wear?
- _____
- _____
3. What is the difference between space-save spare tires and conventional tires?
- _____
- _____

JOB SHEET 22

INSPECTING A RACK AND PINION STEERING SYSTEM

EQUIPMENT, TOOLS AND SUPPLIES

- Hoist
- Trouble light
- Service manual
- Vehicle (with power assisted rack and pinion steering)
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil
- Notepad/inspection checklist

PROCEDURE

Note 1: A classmate is needed as a helper for part of this job sheet.

Note 2: Record your observations on a notepad or inspection checklist.

1. Park, turn off the ignition and safely support and raise the vehicle on the hoist.
2. Put on the protective clothing.
3. Inspect the steering linkage for torn or damaged boots.
4. Inspect the linkage for damaged or missing grease zerks.
5. Have a helper turn the steering wheel slowly from lock to lock. Watch for any binding or resistance in the steering wheel or linkage throughout the travel. Watch the rack and pinion housing for movement through the bushings.

Note: Do not use excessive force at the end of travel, or hold the steering linkage against the steering stop for more than a few seconds.
6. Refer to the service manual to determine the part names and wear tolerances for this steering system.

Note: All of the following inspections involve grasping the parts with both hands and applying enough force to demonstrate if movement is possible. Record your observations.
7. Inspect the rack and pinion housing for leaks and loose mounting bolts and bushings.

8. Inspect the inner ball and socket and outer tie rod ends for looseness.
9. Inspect the tie rod end attachment nut and cotter pin for looseness or damage.
10. Inspect the tie rod end adjustment clamp nut for looseness, shifting and damage.
11. Grasp the top and bottom of a front wheel. Attempt to move the wheel in and out to indicate the amount of wheel bearing free play. Repeat the process for the other front wheel.
12. Lower the vehicle.
13. Move the steering wheel to either side of the straight ahead position to determine free play.
14. As the steering wheel is turned back and forth by a helper, watch the steering linkage and bushings for looseness.
15. Inspect the power steering pump for proper fluid level, and identify any leaks throughout the assist system.
16. Check the smell and colour of the power steering fluid for indications of burning or excessive heat.
17. Inspect the power steering belt for wear and proper adjustment.
18. Return the vehicle to the proper parking area.
19. Ensure windows are rolled up and doors are locked.
20. Return the keys to the teacher/supervisor, and report all problems with the steering system.
21. Clean and return all equipment, tools and supplies to their proper storage areas.
22. Clean up the work area.

23. Using the following chart as a guide, evaluate your performance.

Inspecting a Rack and Pinion Steering System	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All steering parts were properly identified, recorded and reported.				
All steering problems were identified, recorded and reported.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What are the advantages and disadvantages of a rack and pinion steering system?

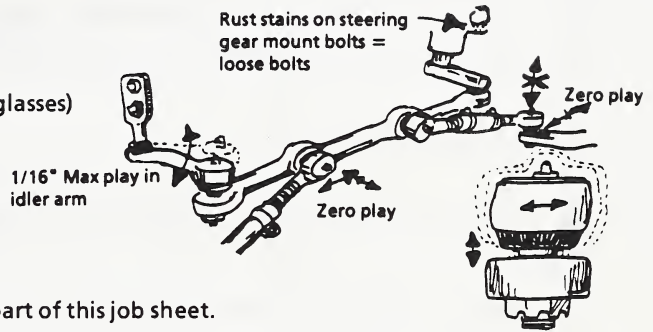
2. What procedures are required to replace common steering parts?

JOB SHEET 23

INSPECTING A PARALLELOGRAM STEERING SYSTEM

EQUIPMENT, TOOLS AND SUPPLIES

- Hoist
- Trouble light
- Service manual
- Vehicle (with parallelogram steering)
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil
- Notepad/inspection checklist



PROCEDURE

Note: A classmate is needed as a helper for part of this job sheet.

1. Park, turn off the ignition and safely support and raise the vehicle on the hoist.
2. Put on the protective clothing.
3. Inspect the steering linkage for torn or damaged boots.
4. Inspect the linkage for damaged or missing grease zerks.
5. Have a helper turn the steering wheel slowly from lock to lock. Watch for any binding or resistance in the steering wheel or linkage throughout the travel.

Note: Do not use excessive force at the end of travel, or hold the steering linkage against the steering stop for more than a few seconds.

6. Refer to the service manual to determine the name and wear tolerances of each part in this steering system.

Note: All of the following inspections involve grasping the parts with both hands and applying enough force to demonstrate if movement is possible. Record your observations.

7. Inspect the steering box for leaks and loose mounting bolts.
8. Inspect the pitman arm for looseness or sign of shifting along the spline.
9. Inspect the idler arm for looseness, wear and damage to the bushings, mounting bolts and arm.

10. Inspect the inner and outer tie rod ends for looseness and damage.
11. Inspect the centre link for damage.
12. Inspect the adjusting sleeves for clamp bolt looseness, sleeve shifting and damage.
13. Grasp the top and bottom of each front wheel. Attempt to move the wheel in and out to indicate the amount of wheel bearing free play.
14. Lower the vehicle.
15. Move the steering wheel to either side of the straight ahead position to determine free play.
16. Watch the steering linkage for looseness as the steering wheel is turned back and forth by a helper.
17. Inspect the power steering pump for proper fluid level and identify any leaks throughout the assist system.
18. Check the smell and colour of the power steering fluid for indications of burning or excessive heat.
19. Inspect the power steering belt for wear and proper adjustment.
20. Return the vehicle to the proper parking area.
21. Ensure windows are rolled up and doors are locked.
22. Return the keys to the teacher/supervisor, and report all problems with the rack and pinion steering system.
23. Clean and return all equipment, tools and supplies to their proper storage areas.
24. Clean up the work area.

25. Using the following chart as a guide, evaluate your performance.

Inspecting a Parallelogram Steering System	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All steering parts were properly identified and reported.				
All steering problems were identified and reported.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What are the advantages and disadvantages of a parallelogram steering system?

2. What procedures are used to replace common steering system parts?

JOB SHEET 24

INSPECTING THE BRAKE SYSTEM

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle (with power assisted brakes)
- Safety stands
- Fender covers (2)
- Floor jack
- Creeper
- Trouble light
- Inspection mirror
- Wheel wrench
- Torque wrench
- Deep socket (six point, lug nut size)
- Protective clothing (e.g., coveralls, dust mask, safety glasses)
- Notepad/inspection checklist
- Pen or pencil

PROCEDURE

Safety Note: Follow the teacher's/supervisor's directions for running vehicles in the shop when completing this job sheet.

1. Park the vehicle on a level surface.
2. With the engine running, apply and release the brake pedal several times to ensure that the pedal moves quietly and smoothly. The pedal should have the proper free play and return quickly after it is released.

Note: Record your observations after each step of the inspection.

3. Shut off the engine and apply the brakes several times to eliminate all vacuum from the power assist system. Hold the pedal down firmly for 90 seconds. The pedal must not move downward during the time the pedal is held down.

Note: Downward movement of the pedal will indicate external or internal fluid leaks.

4. Test the brake power booster for action.

- a. With the engine shut off, pump the pedal several times to eliminate all vacuum.
- b. Depress the brake pedal firmly.
- c. Start the engine.

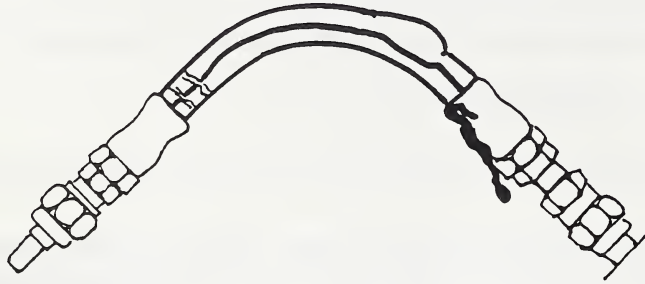
Note: The brake pedal should drop down at least 1 cm.

5. Test the brake power booster vacuum reserve capacity.
 - a. Start the engine and allow it to run and build up vacuum for 30 seconds.
 - b. Shut off the engine.
 - c. Wait for 90 seconds.

Note: Loss of vacuum during the wait indicates a vacuum leak problem.
 - d. Step on the brake pedal firmly. It should have normal free play and firmness.
 - e. Release the brake pedal.
 - f. Apply and release the brake pedal again, to check for normal free play and firmness.
 - g. Repeat the brake application several times. After the second application, the pedal will start to become firmer, and by the fifth application there will be no power assist.
6. Open the hood and place fender covers over each fender.
7. Put on the protective clothing.
8. Check the brake power booster vacuum hose and clamps for loose connections, and swollen or cracked hoses.
9. Inspect the master cylinder for the following problems:
 - improper fluid level
 - dirty or contaminated fluid
 - loose mounting bolts
 - loose or damaged cover and gasket
 - leaking lines or bleeders
 - secondary seal leaks at the rear of the cylinder.

Note: Missing or wrinkled power booster paint under the master cylinder indicates fluid leaks or spills.
10. Remove the hub caps and store in a safe location.
11. Loosen all lug nuts one half turn.

12. Safely lift and support the vehicle for inspection of the remaining brake components.
13. Inspect the brake lines for loose connections, damage or pitting.
14. Inspect the brake hoses for swelling, leaks or cover cracks. Inspect the hose for signs of rubbing on the cover surface.



15. Remove the wheels, and lay them under the vehicle near the location from where they were taken.

Safety Note: Brake linings contain asbestos, a carcinogen. Do not breathe in dust or use compressed air or running water to remove brake dust. Use the method specified by your teacher/supervisor for brake cleaning.

16. Inspect the disc brake unit components for the following problems:
 - caliper seizing, leaking or loose mounting
 - rotor warping, wear or loose wheel bearings
 - disc brake pad wear, loose mounting or lining contamination.

17. Remove the brake drums and inspect the components for the following problems:
 - brake drum wear, cracking or heat checking
 - brake shoe wear or contamination
 - mounting hardware for wear, distortion or damage
 - backing plate for pedestal wear, cracking or loose mounting fasteners
 - wheel cylinder for leaks, rusting, plugged bleeder openings, loose mounting fasteners or seizing.
18. Inspect the park brake linkage for wear, damage, seizing and frayed cables.
19. Install the brake drums.
20. Install the wheels in their original location.
21. Snug up the lug nuts.
22. Lower the vehicle to the floor.
23. Torque the lug nuts to specification.
24. Remove the fender covers.
25. Test the park brake.
 - a. Apply the park brake with firm pressure. Travel should not be excessive.
 - b. Start the engine.
 - c. Carefully put the vehicle in forward gear.
 - d. Attempt to drive the vehicle forward with moderate torque. The vehicle should not move forward.

Safety Note: Perform this test under the direct supervision of your teacher/supervisor. Do not apply excessive torque or the vehicle could be damaged or jump ahead and cause an accident.

26. Return the vehicle to the proper parking area.

27. Ensure windows are rolled up and doors are locked.
28. Return the keys to the teacher/supervisor and report all brake problems.
29. Clean up and dispose of brake dust as directed by your teacher/supervisor.
30. Clean and return all equipment, tools and supplies to their proper storage areas.
31. Clean up the work area.
32. Using the following chart as a guide, evaluate your performance.

Inspecting the Brake System	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All brake components were properly identified, recorded and reported.				
All brake problems were identified and reported.				
Hazardous materials were handled properly.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Can you legally perform brake repairs without the supervision of a journeyman motor mechanic?
Why or why not?

2. How long do brake shoes and pads normally last?

3. What periodic maintenance procedures should be performed on the brake system?

4. How often should brakes be inspected?



JOB SHEET 25

PERFORMING A COMPRESSION TEST

EQUIPMENT, TOOLS AND SUPPLIES

- Compression tester
- Spark plug socket, ratchet and extension
- Fender covers (2)
- Oil can
- Oil
- Shop reference manual
- Vehicle
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil
- Notepad
- Tags

PROCEDURE

Note: Work with another student on this task.

Safety Note 1: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

Safety Note 2: To prevent electrical shock, the power to the ignition must be disconnected before taking a compression test.

1. Put both fender covers in place.
2. With your teacher's/supervisor's permission, start the vehicle and allow the engine to warm up to operating temperature.
3. Look up the compression specifications in the manual, and record them on the "Compression Test Record Chart".
4. Put on the protective clothing.
5. Shut off the engine.
6. Disconnect the ignition coil power source.
7. Remove the spark plug wires by holding and twisting the spark plug boot, while gently pulling the boot off the spark plug. If the wires are not numbered, tag each of them with the appropriate cylinder number as they are removed.

8. Remove the spark plugs.
9. Install the compression tester in the cylinder number 1 spark plug hole.
10. Have your partner depress the gas pedal, and continuously spin the engine over, six times.
11. Record cylinder number 1 "dry" reading on the compression test record chart.
12. Test and record the "dry" readings for the remaining cylinders.
13. Use an oil can to squirt 25 mL of motor oil through the spark plug hole into each cylinder.
14. Have your partner spin the engine over for 15 seconds to distribute the oil.
15. Take a "wet" reading for each cylinder, and record your results.
16. Diagnose the readings, so you can identify any problems and record your answers .
17. Reinstall the spark plugs.
18. Reinstall the spark plug wires, and remove any attached tags.
19. Reconnect the ignition coil power source.
20. Remove the fender covers.
21. Clean and return all equipment, tools and supplies to their proper storage areas.
22. Clean up the work area.
23. Share your completed chart with your teacher/supervisor.

24. Using the following chart as a guide, evaluate your performance.

Performing a Compression Test	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Compression readings were accurate.				
Compression problems were identified and recorded.				
Engine faults were properly diagnosed and recorded.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What can cause low compression readings?

2. What can cause high compression readings?

3. What effect can improper compression pressures have on vehicle performance?

4. What hazards are associated with compression testing?

5. What can happen if the spark plug wire connections are mixed up?



COMPRESSION TEST RECORD CHART

Specification _____ kPa

Cylinder No.	Dry	Wet	Diagnosis
1			
2			
3			
4			
5			
6			
7			
8			

JOB SHEET 26

PERFORMING A VACUUM TEST

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle manual
- Shop manual for vehicle specifications
- Fender covers (2)
- Vacuum gauge
- Vehicle
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil

PROCEDURE

Safety Note 1: The engine must be running for this test. Beware of moving parts and hot surfaces.

Safety Note 2: Throughout this task, refer to the vehicle and shop manuals and follow the teacher's/supervisor's directions for running a vehicle in the shop.

Safety Note 3: Connect an exhaust gases pickup hose to the tail pipe before attempting this job.

1. Put both fender covers in place.

2. Put on the protective clothing.

3. Remove a vacuum hose, with the same diameter as the gauge hose, from intake manifold.

Note: The hose should connect to the intake manifold at a spot that leads directly to the intake passageways.

4. Install the vacuum gauge hose on the open fitting.

Safety Note: Make certain that the hose does not touch hot or moving parts.

5. Start the engine and allow it to run and warm up to operating temperature.

6. Take a vacuum reading at operating temperature and normal curb idle speed. Record the reading as "A" on the following "Vacuum Reading Record Chart".

VACUUM READING RECORD CHART

Readings	Diagnosis/Recommendations
A.	
B.	

7. Take a vacuum reading between 2 000 rpm and 2 200 rpm. Record the reading as "B" on the above chart.
8. Accelerate the engine several times, and watch the vacuum gauge.
9. Shut off the engine.
10. Remove the vacuum gauge.
11. Reinstall the original hose on the intake manifold vacuum fitting.
12. Diagnose any problems and record your recommendations.
13. Remove the fender covers.
14. Clean and return all equipment, tools and supplies to their proper storage areas.
15. Clean up the work area.

16. Using the following chart as a guide, evaluate your performance.

Performing a Vacuum Test	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Vacuum readings were accurate.				
Problem diagnosis and recommendations were accurate.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

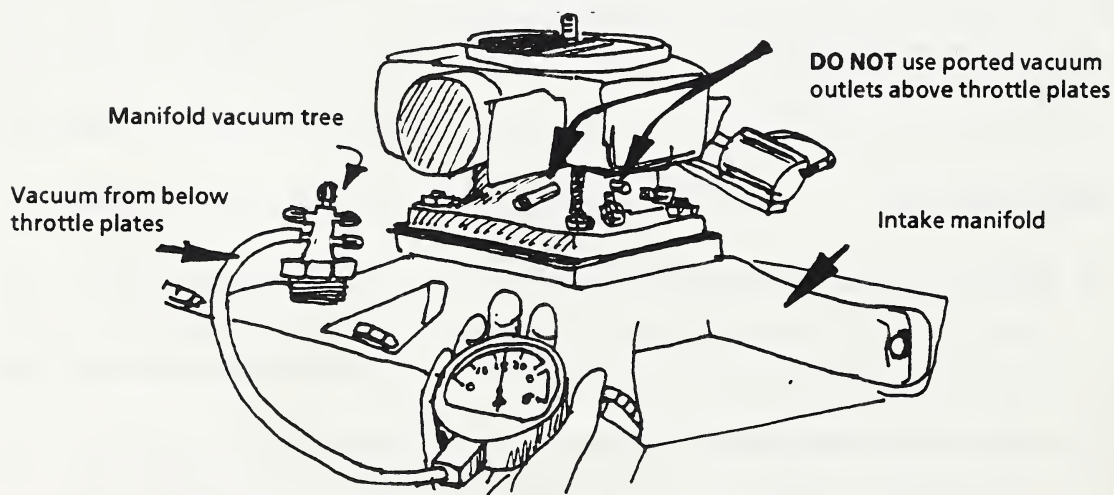
DISCUSSION TOPICS

1. When should a vacuum test be performed?

2. Where can vacuum leaks occur?

3. What methods can be used to identify vacuum leak locations?

4. What damage can a vacuum leak cause over a long period of time?



JOB SHEET 27

PERFORMING A CRANKCASE BLOW-BY TEST

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Fender covers (2)
- Protective clothing (e.g., coveralls, safety glasses)
- Notepad
- Pen or pencil

PROCEDURE

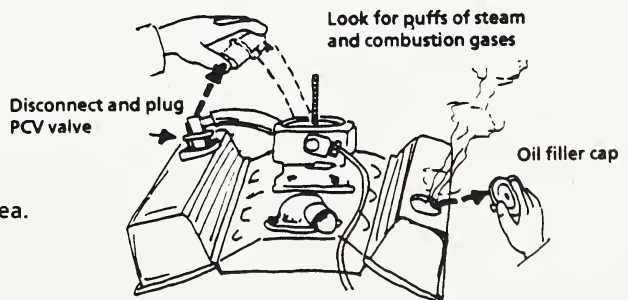
Safety Note: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Open the hood and cover each front fender with a fender cover.
2. Locate the PCV (positive crankcase ventilation) valve, and the oil filler cap in the valve covers.
3. Put on the protective clothing.
4. Start the engine and allow the engine to run at fast idle speed.
5. Remove the oil filler cap.
6. Remove the PCV valve from the valve cover.
7. Watch for excessive blow-by gases coming out of the PCV valve and the oil filler cap openings.

Note 1: A small volume of steam and combustion gases is normal. Puffs of steam and combustion gases indicate a leak from the combustion chamber into the crankcase.

Note 2: Record your observations for steps 7 and 8.

8. Repeat the test at normal idle speed.
9. Reinstall the oil filler cap and PCV valve.
10. Remove the fender covers.
11. Return the vehicle to the proper parking area.



12. Roll up the windows, and lock the doors.
13. Ensure windows are rolled up and doors are locked.
14. Return the keys, and report all problems to the teacher/supervisor.
15. Clean and return all equipment, tools and supplies to their proper storage areas.
16. Clean up the work area.
17. Using the following chart as a guide, evaluate your performance.

Performing a Crankcase Blow-by Test	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Blow-by problems were recognized.				
Engine problems were properly diagnosed and recorded.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. From which areas can compression gases leak into the crankcase area?

2. What damage can be caused by excessive blow-by gases in the crankcase?

3. What effect can excessive crankcase blow-by gases have on engine operation?

JOB SHEET 28

PERFORMING A CYLINDER LEAKAGE TEST

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Cylinder leakage tester
- Compressed air supply
- Spark plug socket
- Ratchet
- Torque wrench
- Fender covers (2)
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil
- Notepad

PROCEDURE

Safety Note 1: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

Safety Note 2: The engine must be at operating temperature for this test. Avoid contact with hot metal parts throughout this procedure.

1. Open the hood and cover each front fender with a fender cover.
2. Put on the protective clothing.
3. Remove the spark plugs, and inspect each one for excessive or unusual deposits. Store the spark plugs so they will not be damaged.
4. Remove the air cleaner.
5. Remove the radiator cap and the oil filler cap.
6. Disconnect the battery ground cable.
7. Install the adapter hose into the number one spark plug hole.

8. Turn the large crank shaft bolt to position piston number one at TDC on the compression stroke.

Safety

Note: Never attempt to turn the engine over when air is applied to the spark plug hole.

Note: The engine must be positioned at exactly TDC, otherwise an improper reading or a sudden engine rotation can result.

9. Apply air pressure to the adapter hose.

Note: If the engine spins over or excessive leakage occurs, the engine must be repositioned properly.

10. Look and listen for leaks at the carburetor throat, exhaust pipe, radiator cap opening, oil filler hole opening or other spark plug holes.
11. Record the leakage reading on the "Cylinder Leakage Test Results Chart".
12. Repeat the test for the remaining cylinders.
13. Remove the adapter hose from the spark plug hole.
14. Install the spark plugs, and tighten them to the specified torque.
15. Install the spark plug wires to the proper spark plugs.
16. Install the air cleaner.
17. Install the oil filler cap.
18. Install the radiator cap.
19. Reconnect the battery ground cable.
20. Remove the fender covers.
21. Return the vehicle to the proper parking area.
22. Ensure windows are rolled up and doors are locked.

23. Return the keys, and report any reading over 20% to your teacher/supervisor.
24. Clean and return all equipment, tools and supplies to their proper storage areas.
25. Clean up the work area.
26. Using the following chart as a guide, evaluate your performance.

Performing a Cylinder Leakage Test	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Engine positioning was correct.				
Leakage readings were accurate.				
Leakage diagnoses were correct.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why does the engine remain stationary if correctly positioned for this test?

2. What could cause air leakage to be heard at the carburetor throat?

3. What could cause air leakage to be heard at the tail pipe?

4. What could cause air leakage to be heard at the adjacent spark plug holes?

5. What could cause air leakage from the cooling system to be heard or seen?

6. What could cause air leakage to be heard at the crankcase fill cap hole?

CYLINDER LEAKAGE TEST RESULTS CHART

Cylinder Number	Leakage Reading	Location of Noise
1		
2		
3		
4		
5		
6		
7		
8		

JOB SHEET 29

PERFORMING A POWER BALANCE TEST

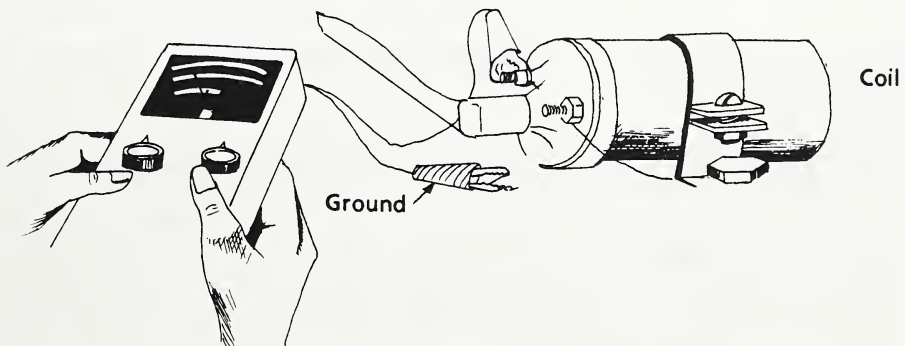
EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Vehicle service manual
- Ignition testing pliers
- Fender covers (2)
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil

PROCEDURE

Safety Note: Throughout this procedure, follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Put on the protective clothing.
2. Open the hood and cover each fender with a fender cover.
3. Locate the proper primary circuit connection point for the tachometer:
 - for engines with an external coil, use the negative terminal of the coil
 - for engines with internal coils, use the TACH terminal on the distributor cap, or other specified point.
4. Connect the red tachometer lead to the proper primary circuit connection point. Connect the black tachometer lead to a ground point on the engine.



5. Start the engine and allow it to return to curb (normal) idle speed.

Safety Note: For the remainder of this procedure, avoid touching hot moving parts.

6. Record the curb idle speed on the "Power Balance Test Results Chart".

7. Identify the cylinder numbers; e.g., number 1, number 2.

8. Pull off the spark plug wire from number 1 cylinder, and immediately ground the plug against the cylinder head.

Note: Some electronic ignition systems may require the use of a calibrated testing spark plug instead of removing the spark plug wire. If the service manual does not specify the precautions required for a power balance test, ask your teacher/supervisor for recommendations.

9. Record the RPM (revolutions per minute) decrease on the power balance test results chart.
10. Reinstall the number 1 spark plug wire.
11. Repeat the procedure for the remaining cylinders.
12. Shut off the engine.
13. Disconnect the tachometer leads, and remove the fender covers.
14. Park the vehicle in the proper parking area.
15. Ensure windows are rolled up and doors are locked.
16. Return the keys to your teacher/supervisor.
17. Study the power "Balance Test Results Chart", and identify the cylinders that demonstrated the least RPM drop.
18. Clean and return all equipment, tools and supplies to their proper storage areas.
19. Clean up the work area.

20. Using the following chart as a guide, evaluate your performance.

Performing a Power Balance Test	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Tachometer hookups were correct.				
Power balance problems were recognized.				
Weak cylinders were identified.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What do small RPM drops indicate?

2. What problems can be identified with a power balance test?

3. What is a primary circuit?

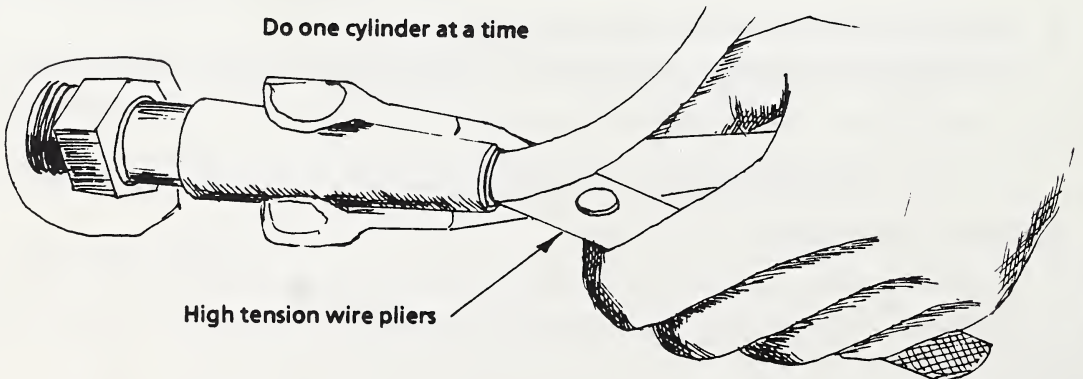
POWER BALANCE TEST RESULTS CHART

Curb Idle Speed _____

RPM

Cylinder Number	RPM Drop
1	
2	
3	
4	
5	
6	
7	
8	

Do one cylinder at a time



High tension wire pliers

JOB SHEET 30

INSPECTING AN ENGINE FOR OIL LEAKS

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Hoist
- Trouble light
- Inspection mirror
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil
- Notepad/inspection checklist

PROCEDURE

1. Park safely, turn off the ignition, raise and support the vehicle on the hoist.
2. Put on the protective clothing.
3. Visually inspect the engine for oil leaks in the following areas:
 - engine oil pan
 - front crankshaft seal
 - rear main seal
 - head gaskets
 - valve cover gaskets
 - oil filler cap gasket
 - PCV valve grommet
 - oil dipstick tube seat
 - oil pump or relief valve
 - oil filter
 - oil drain plug
 - cylinder block plugs
 - oil sending unit
 - intake manifold gasket
 - fuel pump gasket or vent hole
 - timing chain cover
 - inspection or adjustment covers.

Note: Follow the washed trail of oil to the source of the leak. Oil will flow downward and toward the rear of the vehicle.

4. Record and report all oil leak problems to your teacher/supervisor.
5. Lower the vehicle from the hoist, and return it to the proper parking area.
6. Ensure windows are rolled up and doors are locked.
7. Return the keys to your teacher/supervisor.
8. Clean and return all equipment, tools and supplies to their proper storage areas.
9. Clean up the work area.
10. Using the following chart as a guide, evaluate your performance.

Inspecting an Engine for Oil Leaks	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Oil leaks were identified.				
Sources of leaks were properly identified.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

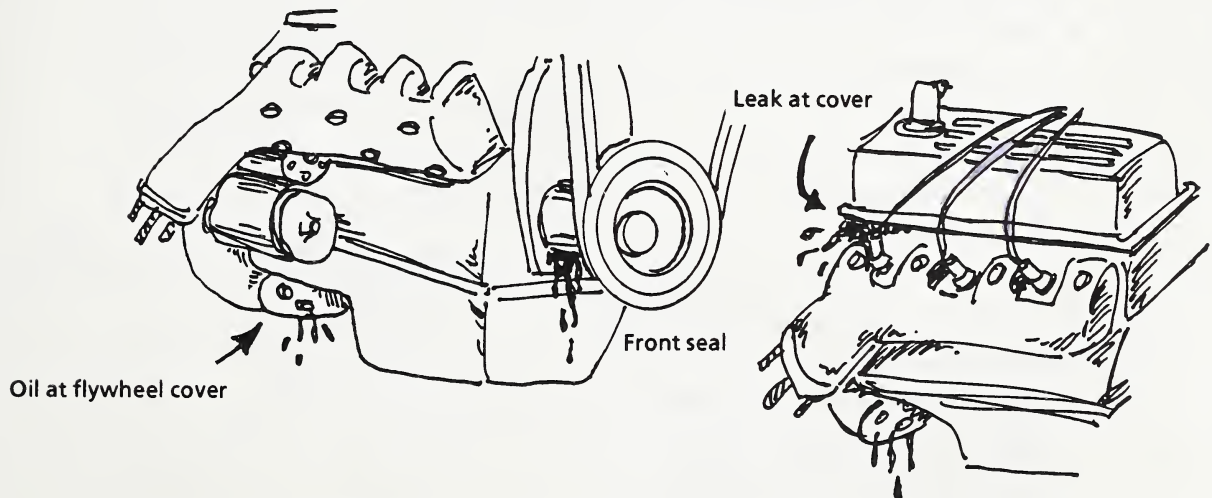
DISCUSSION TOPICS

1. Why are oil leaks dangerous?

2. What procedures are required to replace a rear main seal?

3. How can small leaks be repaired?

4. What periodic maintenance procedures should be included in an engine oil leak inspection?



Look up at rocker cover as oil from there flows down to same area

JOB SHEET 31

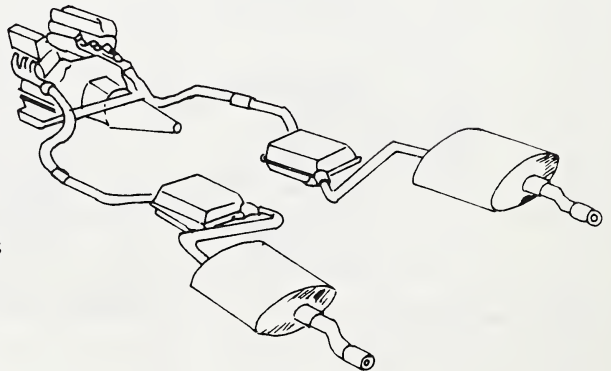
INSPECTING THE EXHAUST SYSTEM

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Hoist
- Trouble light
- Inspection mirror
- Screwdriver
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil
- Notepad/inspection checklist

PROCEDURE

1. Park safely, turn off the ignition, raise and support the vehicle on the hoist.
2. Put on the protective clothing.
3. Inspect the entire exhaust system for the following problems:
 - holes
 - loose connections
 - rust spots
 - surface blisters
 - bent or restricted pipes
 - surface dents
 - cracked or leaking exhaust manifolds
 - missing or broken exhaust manifold bolts
 - seized heat riser valves
 - broken, missing or damaged clamps
 - broken, torn or damaged hangers
 - excessive rusting or flaking layers
 - thin spots.



Note: Check for thin spots by tapping the screwdriver against the bottom of the components.

4. Record and report all exhaust system problems to the teacher/supervisor.

5. Lower the vehicle from the hoist, and return it to the proper parking area.
6. Ensure windows are rolled up and doors are locked.
7. Return the keys to the teacher/supervisor.
8. Clean and return all equipment, tools and supplies to their proper storage areas.
9. Clean up the work area.
10. Using the following chart as a guide, evaluate your performance.

Inspecting the Exhaust System	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All exhaust defects were noted.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

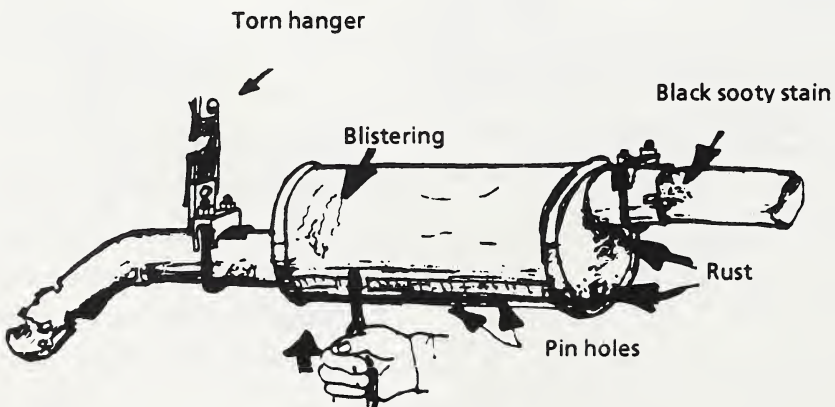
DISCUSSION TOPICS

1. The life of an exhaust system varies. How long do exhaust systems on family cars usually last in your community? Give reasons for your answer.

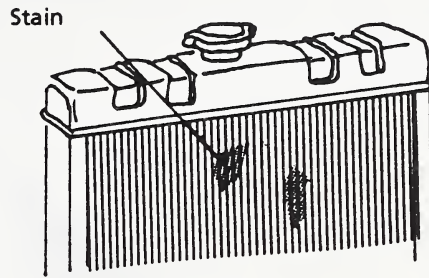
2. How often should the exhaust system be inspected?

3. What hazards are associated with leaking exhaust systems?

4. What is the purpose of a catalytic converter?



10. Inspect the exterior of the radiator for signs of leaks, debris and damage.



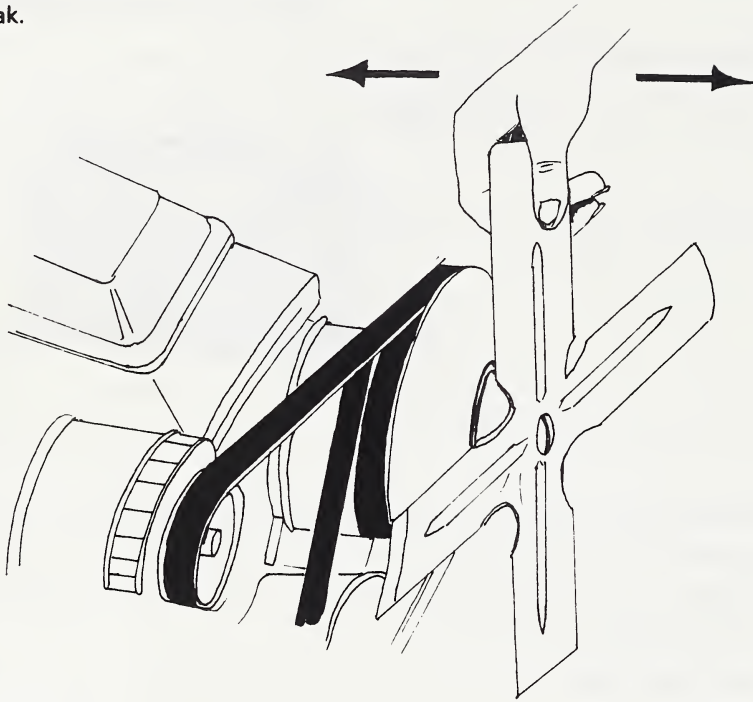
11. Inspect each hose for any of the following problems:

- swelling
- softness
- rubbing marks
- oil contamination
- cracking
- leaking holes or connections
- loose or damaged clamps
- splits
- layer separations.



12. Check the water pump for any of the following problems:

- seal leakage
- bearing or shaft wear
- gasket leak.



13. Install the radiator cap.

14. Report all cooling system problems to the teacher/supervisor.

15. Remove the fender covers.

16. Return the vehicle to the parking area.

17. Ensure windows are rolled up and doors are locked.

18. Return the keys to the teacher/supervisor.

19. Clean and return all equipment, tools and supplies to their proper storage areas.

20. Clean up the work area.

21. a. Prepare an inspection report based upon your inspection and observations.
- b. Share the report with your teacher/supervisor.
22. Using the following chart as a guide, evaluate your performance.

Inspecting the Cooling System	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All cooling system problems were identified, recorded and shared with the teacher/supervisor.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What hazards are associated with ethyl glycol antifreeze?

2. a. What ratio of antifreeze concentrate to water is recommended for coolant?

- b. What is the effect of:

- using too much water?

 - using too little water?

-

JOB SHEET 33

PRESSURE TESTING A COOLING SYSTEM

EQUIPMENT, TOOLS AND SUPPLIES

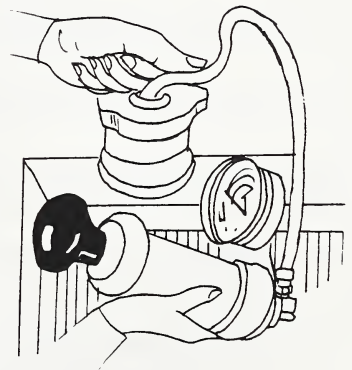
- Vehicle
- Fender covers (2)
- Pressure tester kit
- Rag
- Protective clothing (e.g., coveralls, face shield, safety glasses)
- Pen or pencil
- Notepad

PROCEDURE

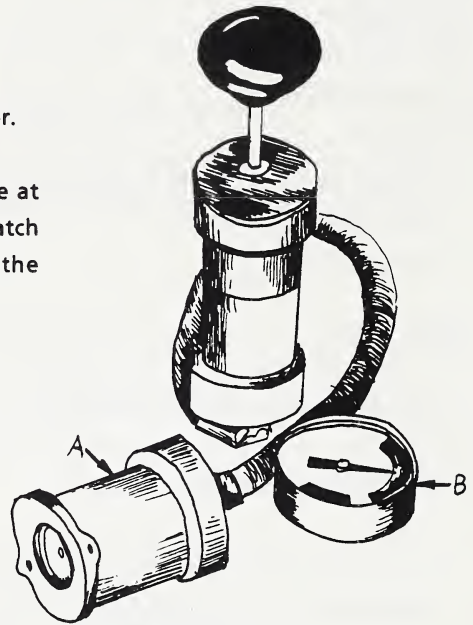
1. Place a fender cover over each fender.
2. Put on the protective clothing.
3. Squeeze the upper radiator hose to check for any pressure.

Safety Note: Do not proceed until the engine has cooled and depressurized enough to remove the radiator cap.

4. Slowly and carefully remove the radiator cap.
5. Install the pressure tester on the radiator filler neck.
6. Check the pressure rating on the radiator cap, and record the specification (see step 19).
7. Pump the handle to move the needle to top of the bar that includes the pressure rating specification.
8. Watch the gauge needle. It should not drop for at least 2 minutes. Any movement indicates a leak in the cooling system.
9. Record your findings (see step 19).



10. Attempt to identify any leaks while the system is under pressure.
11. Relieve the pressure on the tester. This is usually done by tilting the hose at the radiator end of the tool.
12. Install the radiator cap adapter on the tester.
13. Install the radiator cap on the radiator cap adapter.
14. Pump the tester and note the maximum pressure at which the pressure valve releases. It should match the specification on the radiator cap; record the reading.



15. Remove the radiator cap from the adapter.
16. Reinstall the radiator cap on the radiator. Wipe up spilled coolant.
17. Remove the fender covers.
18. Clean and return all equipment, tools and supplies to their proper storage areas.
19. Clean up the work area.
20. Record and diagnose your results to identify problems.

- | | |
|------------------------------|-------|
| ● Radiator cap specification | _____ |
| ● Does cooling system leak? | _____ |
| ● Radiator release pressure | _____ |
| Noted leaks: | _____ |

21. Suggest how each problem may be solved.
22. Using the following chart as a guide, evaluate your performance.

Pressure Testing a Cooling System	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All cooling system problems were identified and recorded.				
Solutions to each problem were suggested.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. At what pressures do modern vehicles operate?

2. What is the purpose of pressure within a cooling system?

JOB SHEET 34

INSPECTING FAN BELTS

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Fender covers (2)
- Trouble light
- Tension gauge (if available)
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil

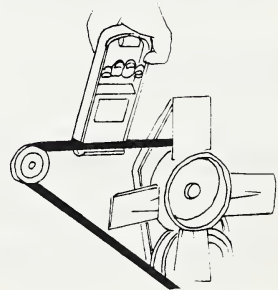
PROCEDURE

Safety Note: Before starting this job, turn off the ignition and remove the key from the ignition switch.

1. Open the hood and cover each fender with a fender cover.
2. Put on the protective clothing.
3. Inspect the condition of the entire fan belt.
4. Check the fan belt tension with either the Belt Strand Tension Gauge Test or the Belt Deflection Test:

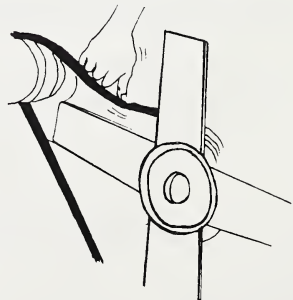
Belt Strand Tension Gauge Test:

- select the longest belt span area
- clamp the tension gauge on the belt in the centre of the span
- read the correct scale according to manufacturer's directions.



Belt Deflection Test:

- select the longest belt span area
- press on the belt with your thumb in the centre of the span
- with moderate pressure (10 kg), the belt should deflect a maximum of 13 mm.



5. Record your observations below.

● Belt condition (note problems)	_____

● Belt tension test selected	_____

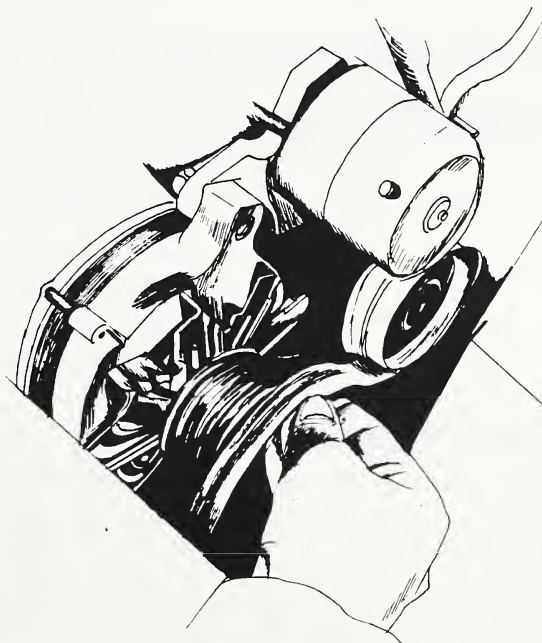
● Belt deflection	_____

6. Notify your teacher or supervisor, if any belt problems are found.

7. Remove the fender covers.

8. Clean and return all equipment, tools and supplies to their proper storage areas.

9. Clean up the work area.



10. Using the following chart as a guide, evaluate your performance.

Inspecting Fan Belts	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All fan belt problems were identified and recorded.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What styles of fan belts are used on vehicles?

2. What is a "matched" belt set?

3. Why are belts used on vehicle accessories instead of chain drives?

4. How are belts measured?

JOB SHEET 35

POWER FLUSHING A COOLING SYSTEM

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Power flusher unit
- Flushing agent
- Flushing "T" of correct size
- Hose clamps (2)
- Cold water tap
- Hose
- Electrical supply
- Water deflector
- Razor knife
- Screwdriver
- Drain pan
- Rags
- Protective clothing (e.g., coveralls, safety glasses or goggles, vinyl gloves)
- Pen or pencil
- Safety container
- Antifreeze
- Exhaust gas pickup hose

PROCEDURE

Note: Before attempting this job, view your teacher's/supervisor's demonstration using a similar machine. Each flushing machine is different and each manufacturer's instructions must be followed. The procedure below provides a general instruction only.

Safety Note 1: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

Safety Note 2: Avoid contact with toxic antifreeze and hazardous cleaning chemicals.

1. Park the vehicle near a floor drain.
2. Put on the protective clothing.
3. Install the exhaust gas pickup hose.
4. Open the radiator drain, and drain the cooling system into the drain pan.
5. Close the radiator drain.
6. Fill the cooling system with cold clean water.

7. Read the flushing agent instructions, and add the container contents to the radiator as directed.
8. Run the engine as described in the flushing agent instructions. Follow the instructions, including any neutralization process.
9. Shut off the engine.
10. Drain the flushing agent into the drain pan.
11. Dispose of the old coolant and flushing agent in an approved safety container.
12. Close the radiator drain plug.
13. Remove the top radiator hose from the radiator.
14. Install the water deflector on the radiator filler neck.
15. Turn on the flushing machine for the required length of time.
16. Turn off the machine.
17. Reinstall the top radiator hose.
18. Add the specified amount of antifreeze to the power flusher tank. Pump the antifreeze into the cooling system.
19. With your teacher's/supervisor's permission, start the engine and check for coolant leaks.
Note: Recheck the coolant strength after the coolant is well mixed.
20. Check for marks on the vehicle, and clean up as required.
21. Clean and return all equipment, tools and supplies to their proper storage areas.
22. Dispose of contaminated rags in an approved safety container.
23. Clean up the work area.

24. Record the amount of antifreeze added to the cooling system.

Amount of antifreeze added _____ litres

25. Using the following chart as a guide, evaluate your performance.

Power Flushing a Cooling System	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Hazardous liquids were handled correctly.				
All cooling system problems were identified and recorded.				
The cooling system deposits were removed.				
The cooling system was refilled properly.				
Antifreeze concentration was correct.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What causes deposits in cooling systems?

2. Why should antifreeze be changed periodically?

3. How often should cooling systems be flushed?

JOB SHEET 36

REPLACING A TOP RADIATOR HOSE

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Top radiator hose
- Tools (as required)
- Antifreeze drain pan
- Rag
- Funnel
- Fender covers (2)
- Wire brush
- Hose slitter (if required)
- Protective clothing (e.g., coveralls, safety glasses, vinyl gloves)
- Safety container
- Exhaust gas pickup hose

PROCEDURE

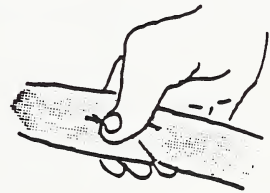
Note: This procedure can be used to replace any coolant hose.

1. Open the hood and place a fender cover over each fender.
2. Put on the protective clothing.

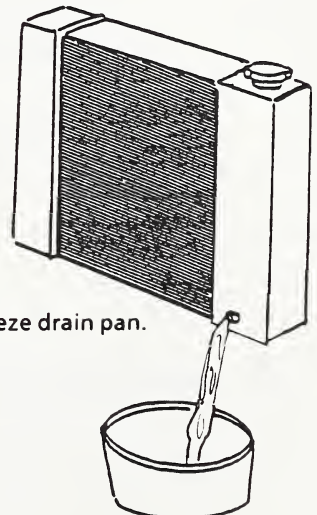


3. Check the cooling system for excess pressure and heat.

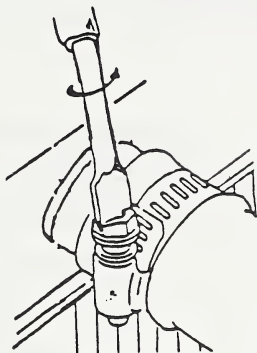
Safety Note: Consult with your teacher/supervisor and do not proceed until directed.



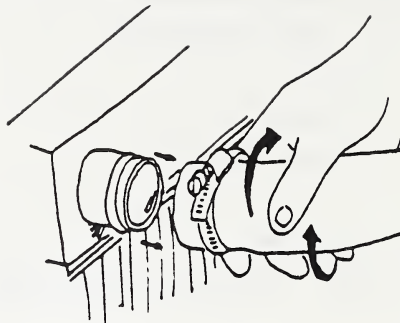
4. Locate the radiator drain plug.
5. Open the radiator drain plug, and drain the coolant into the antifreeze drain pan.



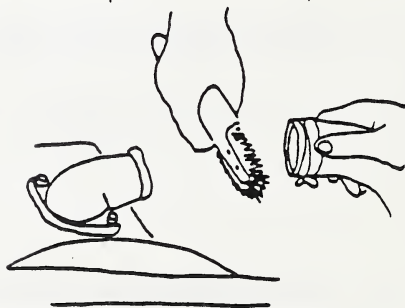
6. Loosen the top radiator hose clamps.



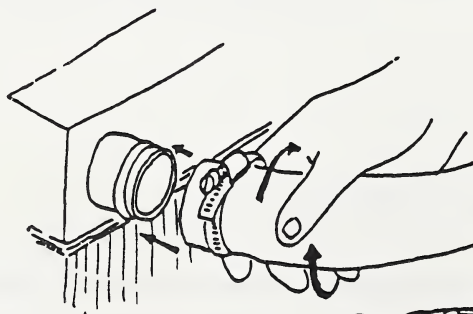
7. Gently twist the hose to break it free. If it sticks, slit the hose.



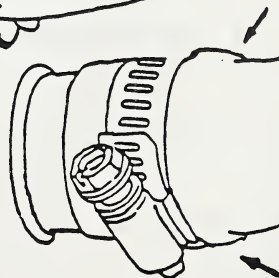
8. Clean the radiator inlet fitting and thermostat housing surface.



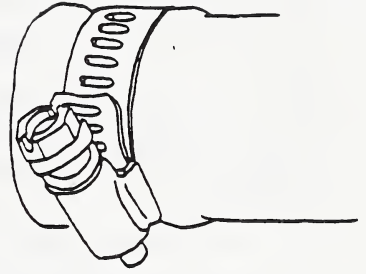
9. Remove the radiator hose clamps.



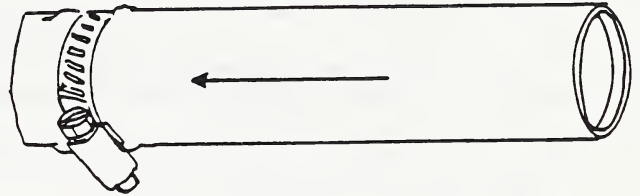
10. Install the clamps on the new hose.



11. Correctly install the new hose. Note the hose markings for proper direction.



12. Tighten the hose clamps until the rubber starts to bulge around the clamps.



13. Close the radiator drain plug.
14. Remove the radiator cap.
15. Using a funnel, pour in the coolant.
16. Check the coolant level, and notify your teacher/supervisor if more coolant is required.
17. Install an exhaust gas pickup hose, start the engine and check for coolant leaks.
18. Clean and return all equipment, tools and supplies to their proper storage areas.
19. Dispose of the old coolant and contaminated rags in an approved safety container.
20. Clean up the work area.

21. Using the following chart as a guide, evaluate your performance.

Replacing a Top Radiator Hose	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Hazardous liquids were handled properly.				
Replacement hose direction was correct.				
Hose clamps were secured.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why do radiator hoses deteriorate?

2. How often should hoses be replaced?

3. What are radiator hoses made of?

JOB SHEET 37

REPLACING A THERMOSTAT

EQUIPMENT, TOOLS AND SUPPLIES

- V8 intake manifold with thermostat
- Plastic-tipped hammer
- Wrenches
- Thermostat
- Torque wrench
- Thermostat housing gasket
- Sockets
- Rags
- Gasket cement
- Protective clothing (e.g., coveralls, safety glasses)
- Vise

PROCEDURE

Safety Note: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Identify the thermostat housing.

2. Put on the protective clothing.

Note: On a operating engine, drain the cooling system as required.



3. Remove the top radiator hose.

4. Remove the bolts holding the thermostat housing.

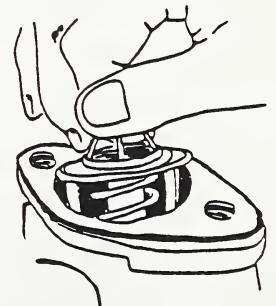
5. Lightly tap on the side of the thermostat housing to break it loose.

6. Remove the old thermostat and housing.

7. Gently clamp the thermostat housing in the vise.

8. Scrape off the old gasket.

9. Install the new thermostat, with the wax pellet inside the manifold.



10. Cement the new gasket in place on the housing.

11. Apply a thin layer of gasket cement to the gasket surface and install the thermostat housing.

12. Install and equally tighten the bolts to specified torque.
13. Reinstall the top radiator hose.
Note: On an operating engine, pour the drained coolant into the radiator. Top up the coolant level and strength as required.
14. Clean and return all equipment, tools and supplies to their proper storage areas.
15. Dispose of contaminated rags in an approved safety container.
16. Clean up the work area.
17. Using the following chart as a guide, evaluate your performance.

Replacing a Thermostat	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Thermostat was installed pellet side in.				
Proper sealant was selected.				
Hose clamps were secured.				
Coolant level was correct.				
Hazardous liquids were handled correctly.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why is the thermostat pellet placed into the engine side of the coolant passageway?

2. What is an "air lock", and how can it be repaired?

3. What types of sealant are available for automotive service work?

4. What is the advantage of an anaerobic sealer?

5. What types of automotive repairs require the use of contact cement?

JOB SHEET 38

INSPECTING A CLUTCH

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle (with an adjustable clutch)
- Hoist
- Trouble light
- Ruler
- Service manual
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

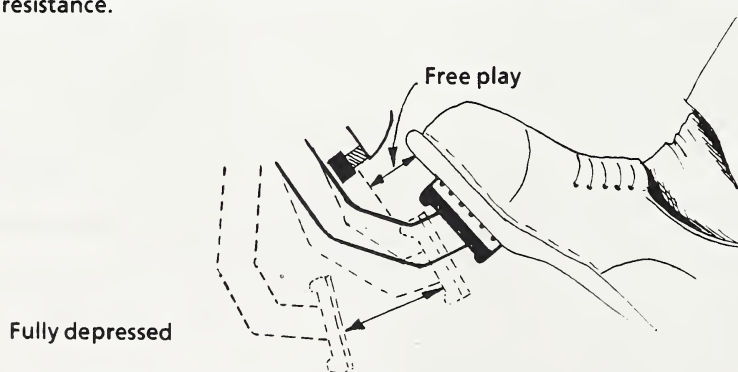
Note: You will need a classmate as a helper for this task.

Safety

Note: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Park the vehicle on the hoist. Shut off the engine.
2. Put on the protective clothing.
3. Use one hand to move the pedal and, with a ruler in your other hand, measure the clutch pedal free play. Free play should be between 2 cm and 4 cm, but refer to the service manual for exact specifications.

Note: Free play is the distance between the top of clutch pedal travel and the point of resistance.



4. Fully depress and release the clutch pedal several times, and listen for sounds as the linkage moves.

5. Identify any noises that are located under the dash or hood.

Note: Ask your teacher/supervisor for advice on lubrication or adjustments that will remove abnormal sounds. Follow the instructions given, and then continue with the procedure.

6. Have a helper get into the vehicle.

7. Safely raise and support the vehicle.

8. Have the helper depress and release the clutch pedal several times. Listen for abnormal noises and binding during movement.

Note: Before continuing this procedure, ask your teacher/supervisor for advice on lubrication or adjustments that will cure abnormal noises.

9. Inspect the linkage for wear and damage.

10. Inspect the bell housing and clutch linkage fasteners for looseness. Tighten them according to specifications.

11. Slide your fingers into the clutch fork opening, and check for oil deposits on the inside of the bell housing.

Note: Reinstall the clutch fork grommet.

12. Lower the vehicle.

13. Put the transmission in neutral and engage the parking brake fully.

14. Start the engine, and slowly depress and release the clutch pedal several times. Listen for abnormal sounds as the release bearing starts to turn.

15. Release the parking brake and back the car off the hoist.

16. Have your teacher/supervisor, or a person designated by your teacher/supervisor, road test the vehicle for proper clutch operation.

Note: The clutch should engage and release smoothly without noise. Slippage should not be noticeable under normal vehicle operation.

17. Return the vehicle to the proper parking area.
18. Ensure windows are rolled up and doors are locked.
19. Return the keys, and report clutch problems to the teacher/supervisor.
20. Clean and return all equipment, tools and supplies to their proper storage areas.
21. Clean up the work area.
22. Using the following chart as a guide, evaluate your performance.

Inspecting a Clutch	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Free play measurement was taken.				
Clutch linkage problems were identified.				
Necessary adjustments and services were made.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Where could oil found on the inside of the bell housing come from?

2. What effect can oil have on clutch operation?

3. What are clutch linings made of?

4. What is the purpose of free play?

5. Some vehicles do not have free play in their clutch design. How can free play be eliminated without component wear and damage?

6. What is the procedure for replacing a clutch?

JOB SHEET 39

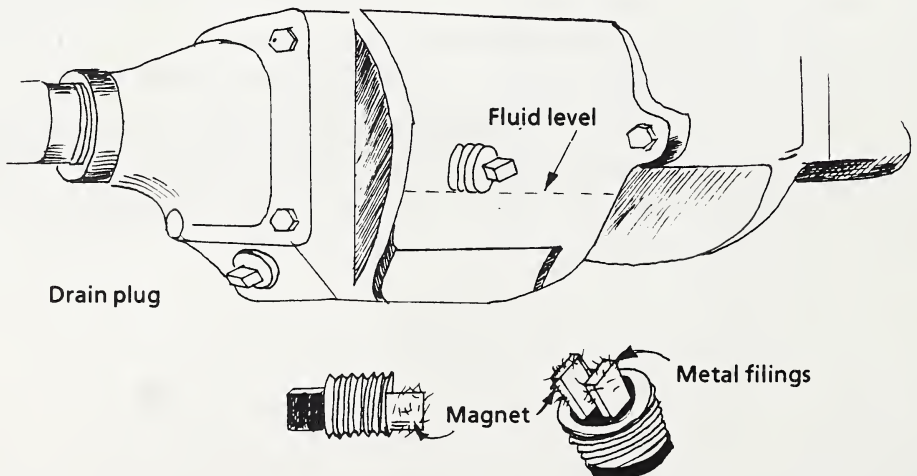
INSPECTING A STANDARD TRANSMISSION

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle (with a standard transmission)
- Hoist
- Trouble light
- Inspection mirror
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

1. Park the vehicle on the hoist, and shut off the engine.
2. Depress the clutch pedal fully.
3. Shift the transmission through its gear ranges. The linkage should move smoothly, and gears should engage solidly.
4. Safely raise and support the vehicle.
5. Put on the protective clothing.
6. Inspect the transmission for external leaks.



7. Remove the gear oil level plug.
8. Check the gear oil level, and inspect the plug for an accumulation of metal filings.
9. Install the gear oil level plug.
10. Check all transmission and bell housing fasteners for looseness.
Note: Tighten all loose fasteners to the specified torque.
11. Inspect the transmission shift linkage for wear and damage.
12. Lower the vehicle.
13. Back the vehicle off the hoist.
14. Have your teacher/supervisor, or a person designated by your teacher/supervisor, road test the vehicle for proper transmission operation.
15. Return the vehicle to the parking area.
16. Ensure windows are rolled up and doors are locked.
17. Return the keys, and report transmission problems to the teacher/supervisor.
18. Clean and return all equipment, tools and supplies to their proper storage areas.
19. Clean up the work area.

20. Using the following chart as a guide, evaluate your performance.

Inspecting a Standard Transmission	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All standard transmission problems were identified and corrected.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What are the advantages and disadvantages of a standard transmission?

2. How do standard transmissions operate?

JOB SHEET 40

INSPECTING AN AUTOMATIC TRANSMISSION

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle (with an automatic transmission)
- Hoist
- Fender covers (2)
- Trouble light
- Inspection mirror
- White paper towels
- Torque wrench
- Service manual for the automatic transmission
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

Safety Note 1: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

Safety Note 2: Avoid contact with moving parts.

1. Start the engine, and allow it to warm up to normal operating temperature.
2. Fully apply the park brake.
3. Depress the brake pedal.
4. Move the shift lever through all positions in the range.
5. Put the shift lever back into the park position.
6. Open the hood, and cover both fenders with a fender cover.
7. Put on the protective clothing.
8. Check the ATF (automatic transmission fluid) level.

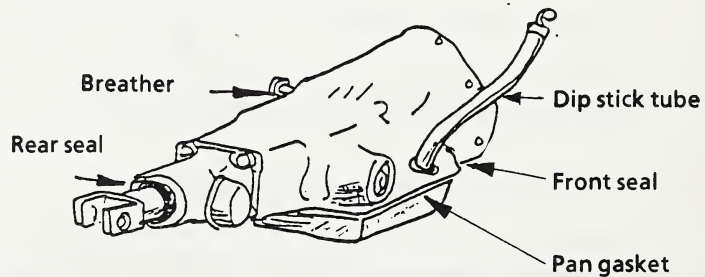
9. Allow some ATF to drip on the paper towels. Inspect the oil patch for deposits.

Look for a dark centre indicating clutch material in fluid



10. Smell the fluid for a burnt odour.
11. Install the ATF dipstick.
12. Shut off the engine.
13. Inspect the transmission modulator valve line at the rear of the intake manifold connection. Look for loose connections or hose cracking or splitting.
14. Safely raise and support the vehicle.
15. Inspect the transmission for leaks in any of the following areas:

- dipstick tube
- front pump seal
- transmission pan gasket
- breather
- transmission oil cooler lines
- gaskets
- housing joints
- fasteners
- extension housing seal.



16. Inspect for loose transmission fasteners on the housings and mounts. Tighten according to the torque specifications.
17. Inspect the rear transmission mount for wear or damage.
18. Lower the vehicle.

19. Using the service manual, determine the shift points for transmission operation.
20. Back the vehicle off the hoist.
21. Have your teacher/supervisor, or a person designated by your teacher/supervisor, road test the vehicle for proper operation.
Note: The teacher/supervisor may require that the fluid level be adjusted prior to road testing.
 - a. All shifts must occur within the specified speed range.
 - b. Transmission shifting must be smooth during upshifts and downshifts.
 - c. All gears must engage during operation.
 - d. Transmission operation must be quiet during normal operating speeds.
22. Return the vehicle to the parking area.
23. Ensure windows are rolled up and doors are locked.
24. Return the keys, and report transmission problems to the teacher/supervisor.
25. Clean and return all equipment, tools and supplies to their proper storage areas.
26. Clean up the work area.

27. Using the following chart as a guide, evaluate your performance.

Inspecting an Automatic Transmission	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All automatic transmission problems were identified, recorded and corrected.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why do shift points vary according to engine load?

2. What other tests can be performed on an automatic transmission?

3. How does the construction of an automatic transmission differ from that of a standard transmission?

JOB SHEET 41

INSPECTING A DRIVE SHAFT

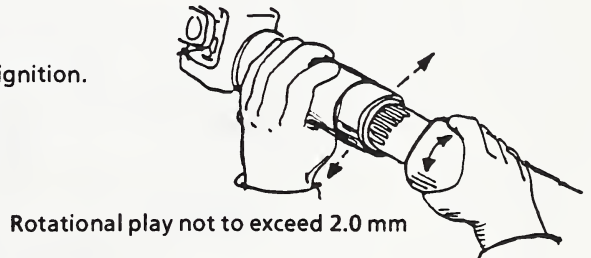
EQUIPMENT, TOOLS AND SUPPLIES

- Hoist
- Trouble light
- Inspection mirror
- Vehicle (with rear wheel drive)
- Service manual
- Protective clothing (e.g., coveralls, safety glasses)
- Notepad/checklist
- Pen or pencil

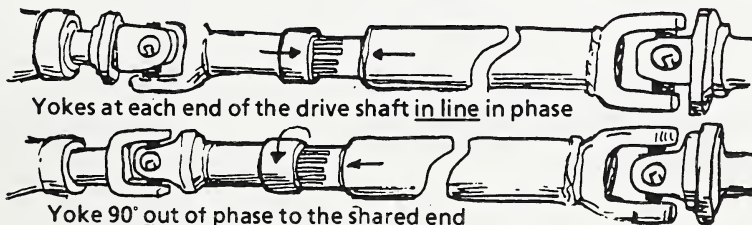
PROCEDURE

Note: The drive shaft you are inspecting may not have all the features described in this procedure. Refer to the service manual for specifications and special measurement procedures, if required.

1. Park the vehicle on the hoist and turn off the ignition.
2. Safely raise and support the vehicle.
3. Put on the protective clothing.
4. Visually inspect the front slip yoke for excessive clearance in the rear extension housing bushing.
5. Inspect the slip joint for excessive wear or clearance. Check that the universal joints are aligned (in phase).

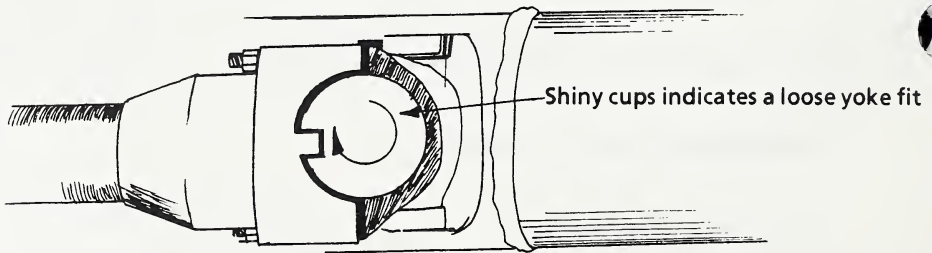
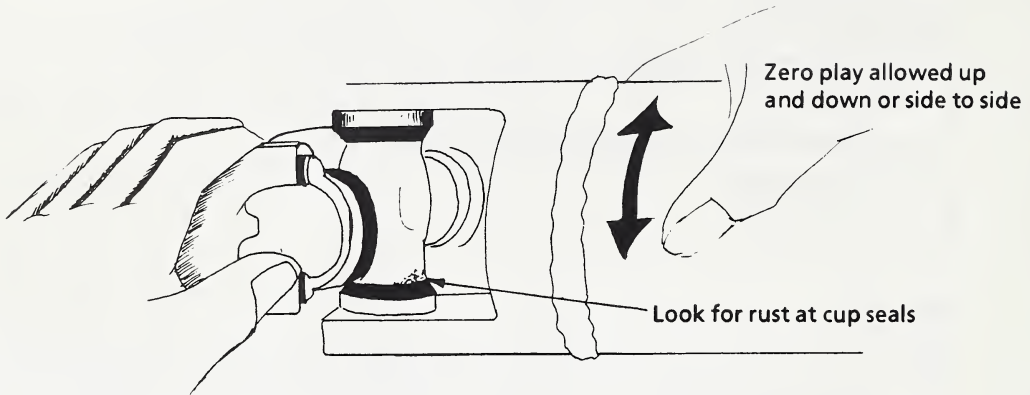


Note: Record your observations after each inspection (steps 4 to 8).



6. Inspect each universal joint for any of the following problems:

- clearance between the cups and cross
- rust dust by the cup seals
- cup movement
- damaged or loose cup clamps.



7. Inspect the fasteners that attach the drive shaft to the rear axle assembly for damage or looseness.

8. Inspect the drive shaft tube surface for bends or dents.

9. Inspect the centre bearing for any of the following conditions:

- worn or damaged bearing mount
- loose mounting bolts
- damaged centre bearing support housing
- worn or rusty bearing.

10. Share your observations with classmates/workmates and your teacher/supervisor and suggest a corrective procedure for each problem identified.
11. Lower the vehicle.
12. Return the vehicle to the parking area.
13. Ensure windows are rolled up and doors are locked.
14. Return the keys, and report all drive shaft problems to the teacher/supervisor.
15. Clean and return all equipment, tools and supplies to their proper storage areas.
16. Clean up the work area.
17. Using the following chart as a guide, evaluate your performance.

Inspecting a Drive Shaft	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All drive shaft problems were identified, recorded and corrective suggestions provided.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What is the purpose of a slip yoke?

2. Why are drive shaft universal joints required?

3. How do large truck drive shafts differ from passenger vehicle drive shafts?

JOB SHEET 42

CHECKING REAR AXLE ASSEMBLY GEAR OIL

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle (with rear wheel drive)
- Floor jack
- Jack stands
- Creeper
- Trouble light
- Rag
- Wrenches
- Hypoid gear oil of correct viscosity
- Vehicle service manual
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil
- Safety container

PROCEDURE

Note: Consult the vehicle service manual before starting this procedure.

1. Put on the protective clothing.
2. Safely raise and support the vehicle on jack stands.
3. Determine correct oil for the unit.
4. Locate the level plug.
5. Hold a rag under the hole, and remove the level plug. Inspect as for standard transmissions.
6. Fill the unit with the correct oil until the oil seeps past the bottom of the hole.
7. Reinstall the level plug.
8. Wipe up all oil spills on the floor and rear axle assembly surface.
9. Record the following information.



Oil type required _____
Amount of oil added _____

10. Lower the vehicle.
11. Return the vehicle to the parking area.
12. Ensure windows are rolled up and doors are locked.
13. Roll up the windows, and lock the doors.
14. a. Return the keys, and report to your teacher/supervisor all gear oil problems and the amount of gear oil added to the rear axle assembly.
b. Suggest how each problem may be solved.
15. Dispose of the contaminated rag in a approved safety container.
16. Clean and return all equipment, tools and supplies to their proper storage areas.
17. Clean up the work area.
18. Using the following chart as a guide, evaluate your performance.

Checking Rear Axle Assembly Gear Oil	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Gear oil level was properly identified and corrected.				
Gear oil problems were identified, recorded and corrective procedures suggested.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What is the purpose of gear oil?

2. What is hypoid oil? Why is hypoid oil required?

JOB SHEET 43

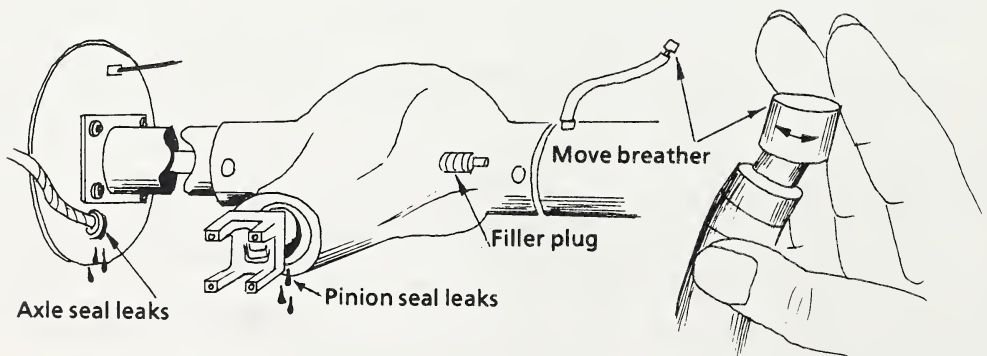
INSPECTING A REAR AXLE ASSEMBLY

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle (with rear wheel drive)
- Hoist
- Trouble light
- Inspection mirror
- Wrench or flex handle to fit level plug drive
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

1. Park the vehicle on the hoist and turn off the ignition.
2. Safely raise and support the vehicle on the hoist.
3. Put on the protective clothing.
4. Inspect the rear axle assembly for leakage at the following points:
 - axle seals
 - pinion seal
 - rear cover gasket
 - breather vent
 - filler plug
 - level plug.



5. Check the gear oil level. Watch for metal filings on the level plug.



6. Move the vent hose, and watch for cracks or a loose hose connection.
7. Check all rear suspension points for loose fasteners.
8. Lower the vehicle.
9. Back the vehicle off the hoist.
10. Have your teacher/supervisor, or a person designated by your teacher/supervisor, road test the vehicle for abnormal noises during both drive and coast conditions.
11. Park the vehicle in the parking area.
12. Ensure windows are rolled up and doors are locked.
13.
 - a. Return the keys, and report all rear axle assembly problems to the teacher/supervisor.
 - b. Suggest a procedure that may be used to correct each problem.
14. Clean and return all equipment, tools and supplies to their proper storage areas.
15. Clean up the work area.

16. Using the following chart as a guide, evaluate your performance.

Inspecting a Rear Axle Assembly	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All rear axle assembly problems were identified, recorded and corrective procedures suggested.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why do rear axle assembly leaks occur?

2. What is a limited slip differential?

3. What absorbs the driving force of the wheels during forward and reverse movement?

JOB SHEET 44

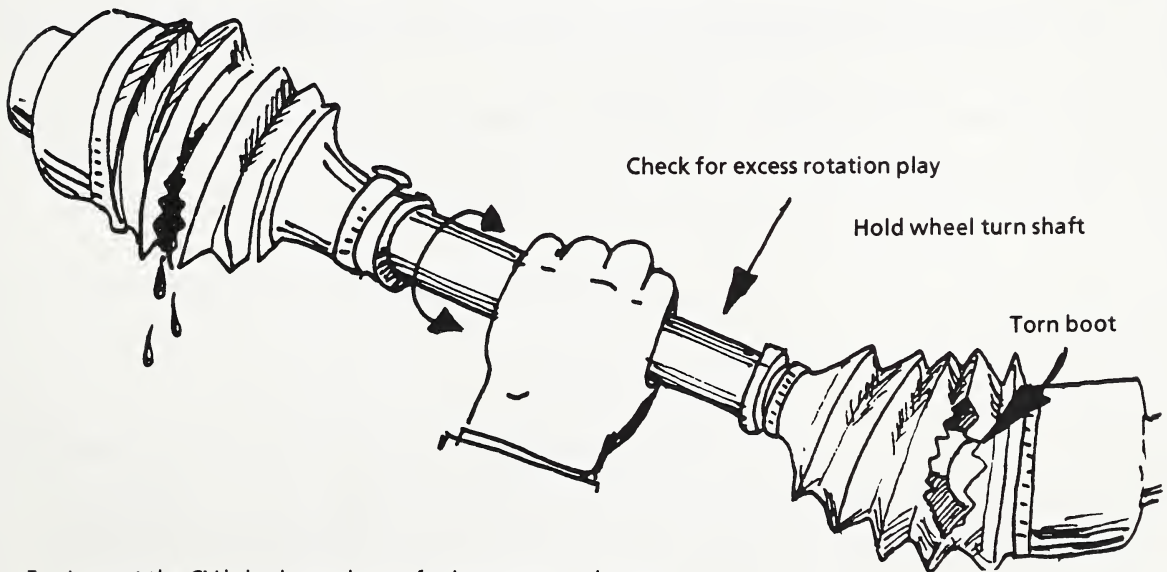
INSPECTING CONSTANT VELOCITY JOINTS

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle (with front wheel drive)
- Hoist
- Trouble light
- Inspection mirror
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

1. Park the vehicle on the hoist and turn off the ignition.
2. Safely raise and support the vehicle in a free wheel position.
3. Put on the protective clothing.
4. Inspect the constant velocity (CV) joint boots for tearing or holes.



5. Inspect the CV joint boot clamps for looseness or damage.

Note: Grease spray on the inner fender surface indicates a leak from the boot.

6. Grasp the front axle shafts, and check for excessive wear and clearance in the joints.
7. Check for external damage to the axle shafts.
8. Lower the vehicle.
9. Back the vehicle off the hoist.
10. Have your teacher/supervisor, or a person designated by the teacher/supervisor, road test the vehicle for abnormal CV joint operation, and noise during acceleration and deceleration. Also listen for clunking or clicking when cornering. Some problems also cause shuddering or vibration when turning.
11. Return the vehicle to the parking area.
12. Ensure windows are rolled up and doors are locked.
13.
 - a. Return the keys, and report CV joint problems to the teacher/supervisor.
 - b. Suggest a procedure that may be used to correct each problem.
14. Clean and return all equipment, tools and supplies to their proper storage areas.
15. Clean up the work area.

16. Using the following chart as a guide, evaluate your performance.

Inspecting Constant Velocity Joints	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All CV joint problems were identified and suggestions made to correct each problem.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What is the difference between CV joints and universal joints?

2. What rear wheel drive designs require the use of CV joints?

3. What are the differences between an inner and outer CV joint?

JOB SHEET 45

REPLACING A HEADLIGHT

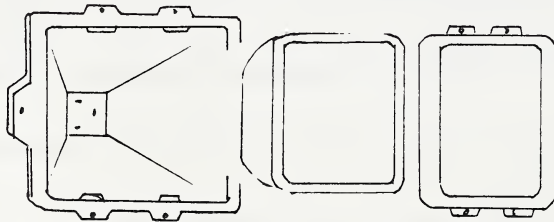
EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Tools (as required)
- Suitable headlight bulb
- Pen or pencil

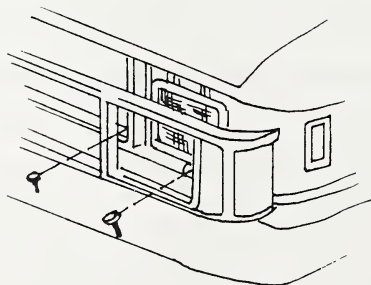
PROCEDURE

Note 1: There are many ways to mount a headlight bulb. This job sheet refers to the replacement of the common sealed beam bulb. Different vehicles may require other ways of accessing the headlight or bulb for replacement.

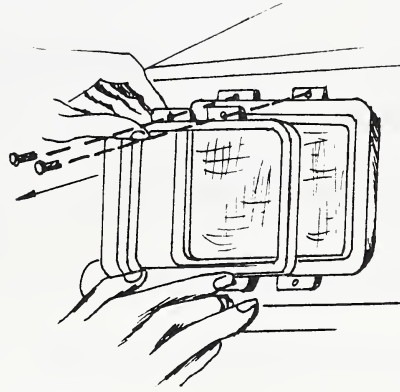
Note 2: Headlight bulbs are positioned in a headlight "bucket" and clamped in with the use of a bezel or retaining ring, which must be removed to release the bulb.



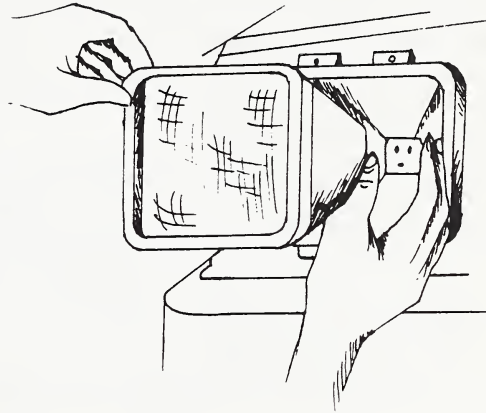
1. Turn on the headlights to determine which bulb is not functioning.



2. Remove the headlight trim.



3. Remove the headlight bezel screws and bezel.



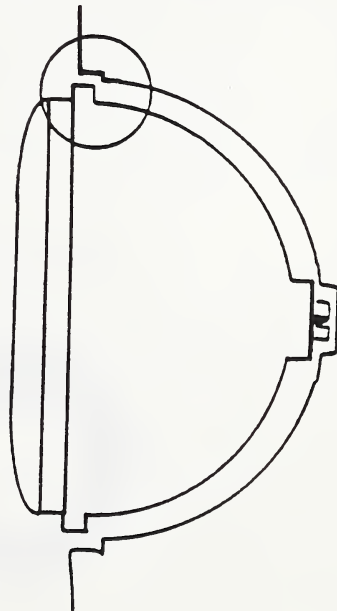
4. Hold the headlight and carefully pull off the connector by grasping the plastic connector and wiggling the connection loose.

Note: DO NOT pull on the wiring.

5. Examine the headlight for:
- cracks (visible inspection)
 - broken filaments (shake bulb and listen)
 - burnt element (smoke stains on glass).

6. Examine the connector for:
- loose connections (wiggle wires)
 - broken wires (wiggle wires).

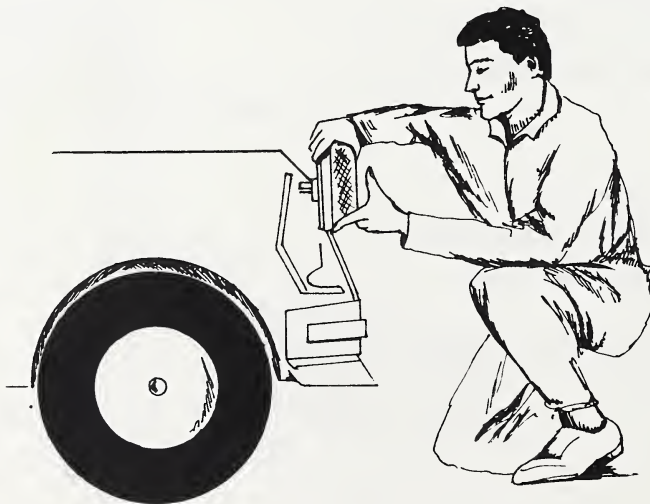
7. Install the connector on the new bulb.



8. Position the bulb in the headlight bucket, making sure the rear glass pedestals sit in the bucket indents.
9. Reinstall the headlight bezel.
10. Reinstall the headlight trim.
11. Check that the headlight bulb works.
12. Clean and return all equipment, tools and supplies to their proper storage areas.
13. Clean up the work area.
14. Record your observations.

Bulb problems:

Connector problems:



15. Using the following chart as a guide, evaluate your performance.

Replacing a Headlight	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Headlight was properly seated and secured.				
Headlight aiming was not disturbed.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What types of headlights are used in modern vehicles?

2. What special procedures are required to replace retractable headlights?

JOB SHEET 46

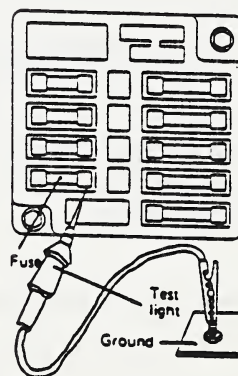
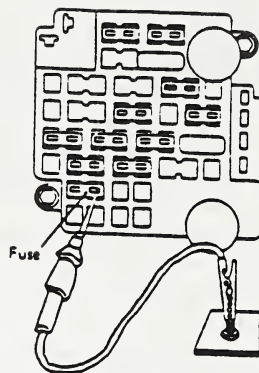
REPLACING A FUSE

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Test light (12 V)
- Trouble light
- Operator's manual
- Replacement fuses

PROCEDURE

1. Locate the fuse box.
2. Attach the test light to a grounded surface.
3. To do this test, turn on the ignition switch and lights, then test each fuse with a test light. Note which fuses do not have power to both sides. Remember to turn off all switches after completing the test.
4. Remove all burnt fuses, and replace with new ones of proper shape and rating.
5. Retest the fuses.
6. Clean and return all equipment, tools and supplies to their proper storage areas.
7. Clean up the work area.



8. Using the following chart as a guide, evaluate your performance.

Replacing a Fuse	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Burnt fuses were identified.				
Proper fuses were installed.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What is the purpose of a fuse?

2. What devices are used in vehicle circuits that frequently have periodic overloads?

JOB SHEET 47

SERVICING A BATTERY

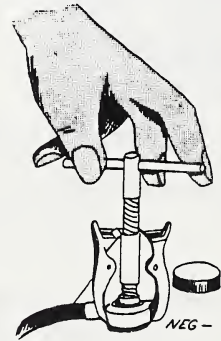
EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Baking soda (50 mL, in a 500 mL solution of warm water)
- Battery filler jug (filled with water)
- Wrenches
- Battery post brush
- Small parts brush
- Battery connection sealant spray
- Rags
- Protective clothing (e.g., coveralls, goggles or face shield, safety glasses, vinyl gloves)

PROCEDURE

- Safety Note 1:** Always disconnect the negative cable before working on the positive cable.
- Safety Note 2:** Batteries contain sulphuric acid that can cause chemical burns. When servicing batteries, wear safety glasses or goggles and vinyl gloves at all times.
- Safety Note 3:** Batteries produce explosive hydrogen gas; therefore, avoid any conditions (e.g., sparks) that may ignite the gas.

1. Put on the protective clothing.
2. Remove the negative battery cable connector from the battery. Use a puller, or spread the clamp as required.
3. Remove the positive battery cable connector from the battery.
4. Make sure the cell caps are tight.



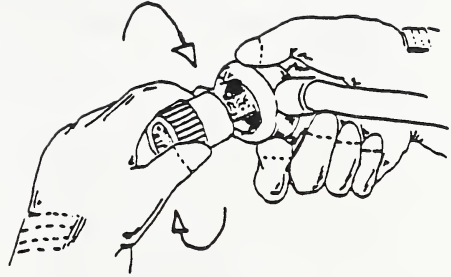
5. Pour the baking soda and water solution over the battery case and cable connectors.

Note: Scrub with a parts brush to remove corrosion.

6. Rinse the battery top with fresh water.

7. Dry the battery and cables.

8. Use the battery post brush to clean the battery posts and the cable connectors.



9. Attach the positive battery cable to the positive terminal.

10. Attach the negative battery cable to the negative terminal.

11. Check the security of the battery hold-down, and tighten if required.

12. Spray all cable connections with sealant spray.

13. For batteries with removeable cell covers:
 - a. pop off the cell covers
 - b. look into the cell to determine the electrolyte level
 - c. add fresh water (distilled, if available) to bring each of the cells to "full" mark; e.g., bottom of split ring
 - d. replace the cell covers.



14. Clean and return all equipment, tools and supplies to their proper storage areas.

15. Dispose of contaminated rags in an approved safety container.

16. Clean up the work area.

17. Using the following chart as a guide, evaluate your performance.

Servicing a Battery	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
All battery problems were identified and corrected.				
Battery was securely mounted.				
Battery connections were cleaned and secured.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What is the difference between maintenance free and conventional lead acid batteries?

2. What hazards are associated with batteries?

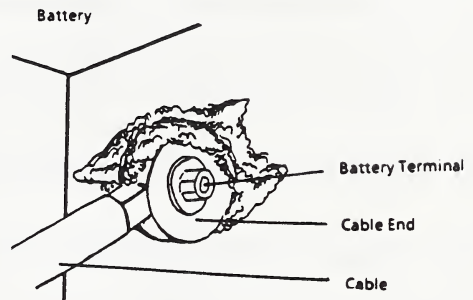
3. How often should batteries be serviced?

JOB SHEET 48

REPLACING A BATTERY CABLE CLAMP

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Battery post brush
- Baking soda (50 mL, in a 500 mL solution of warm water)
- Cable clamps
- Lineman pliers
- Wrenches
- Fender covers (2)
- Battery cable puller
- Screwdriver
- Razor knife
- Battery connection sealant spray
- Rag
- Parts brush
- Protective clothing (e.g., coveralls, safety glasses, goggles or face shield, vinyl gloves)



PROCEDURE

Safety Note 1: Always disconnect the negative cable before working on the positive cable.

Safety Note 2: Batteries contain sulphuric acid that can cause chemical burns. When servicing batteries, wear safety glasses or goggles and vinyl gloves at all times.

Safety Note 3: Batteries produce explosive hydrogen gas; therefore, avoid any conditions (e.g., sparks) that may ignite the gas.

1. Open the hood, and cover each fender with a fender cover.
2. Put on the protective clothing.
3. Loosen the cable clamp bolt.

Safety Note: If replacing the positive cable clamp, first disconnect the negative cable.

4. Gently twist and turn the cable clamp off the battery terminal. If it does not move easily, use a puller or spread the clamp with a screwdriver.

5. Cut off the cable clamp, as close as possible to the end of the clamp.
6. Cut off a 15 mm section of insulation from the end of the cable.
7. Using a brush and the baking soda and water solution, clean off all cable conductor corrosion.
8. Dry the exposed cable conductor.
9. Lie the exposed cable conductor in position on the new cable clamp.
10. Clamp the cable conductor to the cable clamp.
11. Clean the battery terminal with the battery post brush until the metal is clean and shiny.
12. Check and clean the contact surface of the cable clamp until it is clean and shiny.
13. Install the cable end on the battery post.
14. Tighten the cable clamp bolt.
15. Check that the cable end is secure.
16. Spray the connection with battery connection sealant.
17. Remove the fender covers and close the hood.
18. Clean and return all equipment, tools and supplies to their proper storage areas.
19. Clean up the work area.

20. Using the following chart as a guide, evaluate your performance.

Replacing a Battery Cable Clamp	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Cable corrosion was cleaned off.				
Cable connections were cleaned and secured.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What causes battery cable deterioration?

2. What can be done to slow down battery cable clamp deterioration?

JOB SHEET 49

REPLACING A BATTERY

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Replacement battery
- Battery post/terminal brush
- Tools as required
- Fender covers (2)
- Battery connection sealant spray
- Protective clothing (e.g., coveralls, safety glasses, goggles or face shield, vinyl gloves)

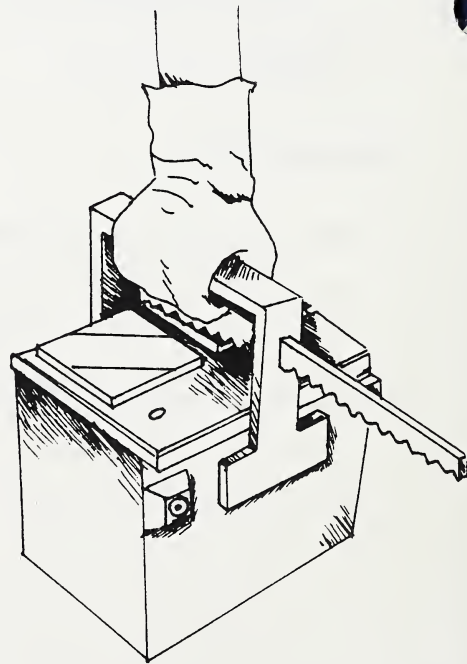
PROCEDURE

Safety Note 1: Always disconnect the negative cable before working on the positive cable.

Safety Note 2: Batteries contain sulphuric acid that can cause chemical burns. When servicing batteries, wear safety glasses or goggles and vinyl gloves at all times.

Safety Note 3: Batteries produce explosive hydrogen gas; therefore, avoid any conditions (e.g., sparks) that may ignite the gas.

1. Open the hood, and cover each fender with a fender cover.
2. Put on the protective clothing.
3. Disconnect the negative battery cable clamp from the battery terminal.
4. Disconnect the positive battery cable clamp from the battery terminal.
5. Remove the battery hold-down.
6. Note the position of the positive battery terminal.



7. Lift out the old battery by hand, or with a suitable lifting device.
8. Install the new battery with the positive terminal in the same position as in the old battery.
9. Install the battery hold-down.
10. Clean and install positive and then negative battery cable clamps.
11. Spray the cable connection with battery connection sealant spray.
12. Remove the fender covers and close the hood.
13. Clean and return all equipment, tools and supplies to their proper storage areas.
14. Clean up the work area.
15. Using the following chart as a guide, evaluate your performance.

Replacing a Battery	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
The battery was securely mounted.				
Connections were cleaned and secured.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why do batteries deteriorate?

2. To what does the term "cold cranking amps" refer?

3. To what does the term "reserve capacity" refer?



JOB SHEET 50

PERFORMING A BATTERY VOLTAGE TEST

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Voltmeter
- Fender covers (2)
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil

PROCEDURE

Safety Note: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Park the car on a level surface and shut off the engine.
2. Open the hood, and cover each fender with a fender cover.
3. Put on the protective clothing.
4. Turn on the headlight switch for 30 seconds to relieve the battery surface charge.
5. Shut off the headlight switch.
6. Turn the voltage range selection switch to the 0 volt to 20 volt range.

Note: Your voltmeter may have a different range selection; pick the selection that has the high voltage reading of 15 volts to 40 volts.

7. Connect the red voltmeter lead clip to the positive battery post connection.
8. Connect the black voltmeter lead clip to the negative battery post connection.
9. Read and record the current battery voltage on the appropriate scale.

Battery voltage: _____ V.

10. Disconnect the voltmeter connections, and remove the voltmeter and fender covers from the vehicle.
11. Close the hood.
12. Return the vehicle to the parking area.
13. Ensure windows are rolled up and doors are locked.
14. Return the keys, and report the battery voltage to the teacher/supervisor.
15. Clean and return all equipment, tools and supplies to their proper storage areas.
16. Clean up the work area.
17. Using the following chart as a guide, evaluate your performance.

Performing a Battery Voltage Test	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Voltmeter connections were correct.				
Voltmeter readings were accurately read and recorded.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why does the actual battery voltage reading differ from the common 12 volts or 24 volts?

2. What hazards are associated with battery testing?

JOB SHEET 51

PERFORMING A STARTER CURRENT DRAW TEST

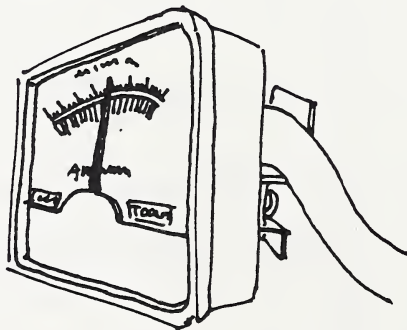
EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Induction meter
- Fender covers (2)
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil

PROCEDURE

Note: You will require the assistance of a helper in this procedure.

1. Park the vehicle on a level surface.
2. Open the hood, and cover each fender with a fender cover.
3. Put on the protective clothing.
4. Disconnect the power connection to the coil at the " + " or POS terminal of the coil or distributor cap.
5. Place the large groove in the back of the induction meter over one of the battery cables.



6. Have a helper turn the ignition switch to the start position for a time, long enough to read and record a current draw reading.

Starter current draw: _____ A.

Note: Four and six cylinder engines' normal starter draw is approximately 100 amperes to 150 amperes. Eight cylinder engines' normal starter draw is 150 amperes to 250amperes.

7. Turn off the ignition switch.
8. Remove the induction meter and fender covers from the vehicle. Close the hood.
9. Return the vehicle to the parking area.
10. Ensure windows are rolled up and doors are locked.
11. Return the keys, and report the starter current draw to the teacher/supervisor.
12. Clean and return all equipment, tools and supplies to their proper storage areas.
13. Clean up the work area.

14. Using the following chart as a guide, evaluate your performance.

Performing a Starter Current Draw Test	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Current readings were accurately read and recorded.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why do larger engines have higher current draw readings?

2. How do induction meters sense current flow?

3. What do excessive readings indicate?

JOB SHEET 52

PERFORMING AN ALTERNATOR OUTPUT VOLTAGE TEST

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Voltmeter
- Fender covers (2)
- Protective clothing (e.g., coveralls, safety glasses)
- Pen or pencil

PROCEDURE

Note: You will require the assistance of a helper to complete this procedure.

Safety

Note: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Park the vehicle on a level surface.
2. Open the hood, and cover each fender with a fender cover.
3. Put on the protective clothing.
4. Connect the red voltmeter lead clip to the positive battery post connection.
5. Connect the negative voltmeter lead clip to the negative battery post connection.
6. Have a helper start the engine and run the engine at fast idle speed.
7. Read and record the highest voltage reading shown on the voltmeter scale.
Alternator output: _____ V.
8. Shut off the engine.
9. Remove the voltmeter and fender covers from the vehicle. Close the hood.
10. Return the vehicle to the parking area.

11. Ensure windows are rolled up and doors are locked.
12. Return the keys, and report the alternator maximum voltage output to the teacher/supervisor.
13. Clean and return all equipment, tools and supplies to their proper storage areas.
14. Clean up the work area.
15. Using the following chart as a guide, evaluate your performance.

Performing an Alternator Output Voltage Test	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Alternator output voltage reading was accurately read and recorded.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What components are included in the charging system?

2. What is the purpose of each charging system component?

3. Why are alternator voltage output levels higher than battery voltage levels?

4. What problems can affect alternator voltage output?

JOB SHEET 53

PERFORMING A SPARK PLUG WIRE RESISTANCE TEST

EQUIPMENT, TOOLS AND SUPPLIES

- Ohmmeter
- Selection of spark plug wires
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

1. Put on the protective clothing.
2. Turn the ohmmeter selection switch to the 0 ohm to 20 000 ohm range.
3. Connect the ohmmeter lead clips together.
4. Move the ohm adjustment knob to align the needle with the zero mark.
5. Disconnect the ohmmeter lead clips from each other.
6. Connect an ohmmeter lead clip to each end of a spark plug wire.
7. Note the resistance reading on the appropriate scale.
8. Disconnect the ohmmeter lead clips from the spark plug wire.
9. Test the remaining spark plug wires.
10. Clean and return all equipment, tools and supplies to their proper storage areas.
11. Clean up the work area.

12. Using the following chart as a guide, evaluate your performance.

Performing a Spark Plug Wire Resistance Test	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Resistance readings were accurate.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. What is the purpose of resistance in a spark plug wire?

2. How does resistance affect electrical flow through a wire?

3. Do spark plug wire resistance specifications vary in different types of ignition systems? Why or why not?

4. Is resistance a desirable feature for all electric circuits? Why or why not?

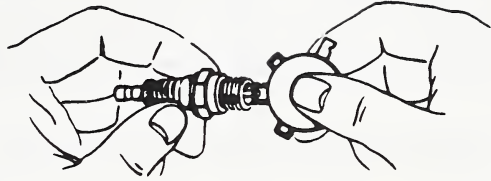
5. What components are included in the ignition system?

JOB SHEET 54

REPLACING SPARK PLUGS

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Spark plug socket
- Extensions
- Ratchet
- Torque wrench
- Spark plugs
- Service manual
- Fender covers (2)
- Service manual with a spark plug inspection guide
- Protective clothing (e.g., coveralls, safety glasses)



PROCEDURE

Safety Note: Throughout this task, refer to the service manual and follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Park the vehicle on a level surface.
2. Put on the protective clothing.
3. Open the hood, and cover each fender with a fender cover.
4. Allow the engine to cool off enough before handling the "hot" spark plugs.
5. Remove the spark plug wire from number 1 spark plug.
6. Position the spark plug socket over the spark plug.
7. Use the ratchet and extensions, as required, to remove the spark plug.
8. Examine the spark plug, and compare the deposits to the pictures in the spark plug inspection guide.

9. Store the used spark plug in a location where it can be identified.
10. Check and adjust the spark plug gap according to specifications.
11. Screw the spark plug into the spark plug hole as far as possible by hand.
12. Install the spark plug socket over the new spark plug.
13. Tighten the spark plug to the specified torque.
14. Securely reconnect the spark plug wire.
15. Repeat the procedure for each of the remaining spark plugs.
16. Start the engine to ensure that spark plug wires have been properly connected.
Note: Hard starting, backfiring and loud explosions are indicators of improper connections. Make reconnections as directed by your teacher/supervisor.
17. Remove the fender covers and close the hood.
Note: Follow the shop policy on the return of customers' used parts.
18. Return the vehicle to the parking area.
19. Ensure windows are rolled up and doors are locked.
20. Return the keys to the teacher/supervisor.
21. Clean and return all equipment, tools and supplies to their proper storage areas.
22. Clean up the work area.

23. Using the following chart as a guide, evaluate your performance.

Replacing Spark Plugs	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
The spark plug gap was accurate.				
The spark plug torque was accurate.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why do spark plugs deteriorate?

2. How often should spark plugs be replaced?

3. Why is spark plug torque important?

JOB SHEET 55

ADJUSTING IGNITION TIMING

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Timing light
- Tachometer
- Tire crayon
- Service manual
- Fender covers (2)
- Trouble light
- Wire brush
- Rag
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

Safety Note: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Park the vehicle on a level surface, and shut off the engine.
2. Put on the protective clothing.
3. Open the hood, and cover each fender with a fender cover.
4. Using the service manual or under hood emissions specifications decal, determine the correct ignition timing specification.
5. Identify the harmonic balancer ignition timing marks on the front of the crankshaft.
6. Identify the pointer or scale on the timing cover.
7. Clean off the timing marks, scales and pointer required for determining the ignition timing of this unit.

8. Using the tire crayon, indicate the specified timing mark on the timing scale located on either the timing cover or harmonic balancer.
9. Hook up the tachometer.
10. Start the engine, and allow it to warm up to operating temperature.
11. Tap the accelerator pedal to release the choke and fast idle cam.
12. Run the engine at the specified RPM for ignition testing.
13. Remove and plug hoses as directed by the manufacturer.
Note: Most vehicles require the disconnecting and plugging of the distributor vacuum advance connection before ignition timing testing.
14. Hook up the timing light.
 - a. Hook the induction pickup onto the number 1 spark plug wire. Slip the connection down the wire to the spark plug boot, but do not allow the connection to touch the hot exhaust manifold.
 - b. Connect the red coloured lead to the battery positive terminal.
 - c. Connect the black coloured lead to an engine ground.
15. Point the timing light at the timing scale, and repress the timing light trigger.
Safety Note: Avoid contact with moving parts.
16. Read the current ignition timing setting by identifying the scale reading opposite the pointer.
17. Loosen the distributor clamp, and turn the distributor to achieve the correct ignition timing setting.
18. Tighten the distributor clamp.
19. Check the ignition timing setting.

20. Reconnect all vacuum hoses.
21. Adjust the engine RPM to curb idle speed.
22. Remove the tachometer and fender covers.
23. Close the hood.
24. Return the vehicle to the parking area.
25. Ensure windows are rolled up and doors are locked.
26. Return the keys to the teacher/supervisor.
27. Clean and return all equipment, tools and supplies to their proper storage areas.
28. Clean up the work area.

29. Using the following chart as a guide, evaluate your performance.

Adjusting Ignition Timing	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Distributor clamp was secured.				
Ignition timing was accurately adjusted.				
Vacuum hoses were reinstalled.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why are ignition timing settings specified?

2. Can ignition timing settings change?

3. What problems are associated with improper ignition timing?

4. Why would an ignition timing setting be changed from a specification?

JOB SHEET 56

PERFORMING AN IGNITION TIMING ADVANCE TEST

EQUIPMENT, TOOLS AND SUPPLIES

- Timing light
- Tachometer
- Tire crayon
- Service manual
- Vehicle
- Fender covers (2)
- Trouble light
- Wire brush
- Rag
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

Safety Note: Throughout this task, follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Park the vehicle on a level surface, and shut off the engine.
2. Put on the protective clothing.
3. Open the hood, and cover each fender with a fender cover.
4. Using the service manual or under hood emissions specifications decal, determine the correct ignition timing specification and advance specification.
5. Identify the harmonic balancer ignition timing marks on the front of the crankshaft.
6. Identify the pointer or scale on the timing cover.
7. Clean off the timing marks, scales and pointer required for determining the ignition timing of this unit.

8. Using the tire crayon, indicate the specified timing mark on the timing scale located on either the timing cover or on the harmonic balancer.
9. Hook up the tachometer.
10. Start the engine, and allow it to warm up to operating temperature.
11. Tap the accelerator pedal to release the choke and fast idle cam.
12. Run the engine at the specified RPM for ignition testing.
13. Remove and plug hoses as directed by the manufacturer.
Note: Most vehicles require the disconnection and plugging of the distributor vacuum advance connection before ignition timing testing.
14. Hook up the timing light.
15. Determine the current ignition timing setting by identifying the scale reading opposite the pointer.
16. Adjust the distributor to achieve the correct ignition timing setting.
17. Speed up the engine to the specified RPM for advance testing.
Note: The service manual may recommend various vacuum readings and connections at several engine speeds to test thoroughly the centrifugal and vacuum advance operation.
18. Check the ignition timing setting.
Safety Note: Avoid contact with moving parts.
19. Compare the ignition timing advance achieved with the specifications.
20. Reconnect all vacuum hoses.
21. Adjust the engine RPM to curb idle speed.
22. Remove the tachometer and fender covers.

23. Close the hood.
24. Return the vehicle to the parking area.
25. Ensure windows are rolled up and doors are locked.
26. Return the keys, and report advance problems to the teacher/supervisor.
27. Clean and return all equipment, tools and supplies to their proper storage areas.
28. Clean up the work area.
29. Using the following chart as a guide, evaluate your performance.

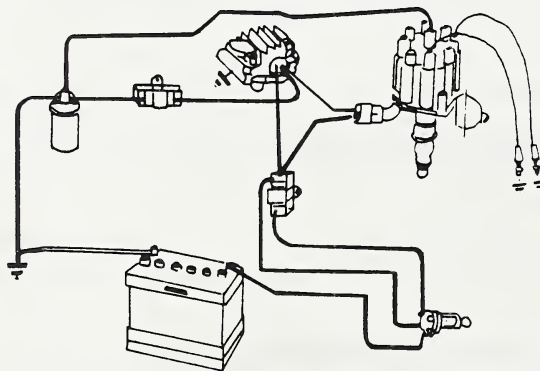
Performing an Ignition Timing Advance Test	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Ignition timing advance reading was accurately adjusted.				
Distributor clamp was secured.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why is ignition timing advance required?

2. What is the difference between vacuum advance and centrifugal advance operations?

3. What problems can affect advance operation?



Ignition System

JOB SHEET 57

REPLACING SPARK PLUG WIRES

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Service manual
- Fender covers (2)
- Trouble light
- Spark plug wire set
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

Safety Note: Throughout this task, refer to the service manual and follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Park the vehicle on a level surface, and shut off the engine.
2. Put on the protective clothing.
3. Open the hood, and cover each fender with a fender cover.
4. Open the spark plug wire box, and arrange the wires according to length.
5. Identify the longest old spark plug wire.
6. Replace the old spark plug wire with the longest new spark plug wire.
Note: The new wire must follow the same route as the old wire.
7. Check that the new spark plug wire is securely connected.
8. Repeat the process to replace the remaining spark plug wires.
9. Check that the new spark plug wires do not touch any hot or moving parts.
10. Start the engine to ensure that the spark plug wires are connected properly.

11. Remove the fender covers, and close the hood.
12. Return the vehicle to the parking area.
13. Ensure windows are rolled up and doors are locked.
14. Return the keys to the teacher/supervisor.
15. Clean and return all equipment, tools and supplies to their proper storage areas.
16. Clean up the work area.
17. Using the following chart as a guide, evaluate your performance.

Replacing Spark Plug Wires	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Each spark plug's wiring was correctly connected.				
Each spark plug connection was secured.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why do spark plug wires deteriorate?

2. What problems are associated with defective spark plug wires?

JOB SHEET 58

REPLACING A DISTRIBUTOR CAP AND ROTOR

EQUIPMENT, TOOLS AND SUPPLIES

- Vehicle
- Timing light
- Tachometer
- Screwdriver
- Tire crayon
- Service manual
- Fender covers (2)
- Trouble light
- Distributor cap
- Rotor
- Protective clothing (e.g., coveralls, safety glasses)

PROCEDURE

Safety Note: Throughout this task, refer to the service manual and follow the teacher's/supervisor's directions for running a vehicle in the shop.

1. Park the vehicle on a level surface, and shut off the engine.
2. Put on the protective clothing.
3. Open the hood, and cover each fender with a fender cover.
4. Disconnect the power connection from the distributor cap (if present).
Note: Do not disconnect the spark plug wires at this time.
5. Release or unscrew the distributor cap hold-down fasteners.
6. Lift the distributor up slightly, and slide it over the rotor to the side of the distributor.
Note: Do not disconnect the spark plug wires from the distributor cap.
7. Remove the old rotor.

8. Install the new rotor.

9. Install the new distributor cap.

Note: The cap must sit securely and accurately on the distributor housing before latching.

10. Identify the number 1 spark plug wire.

11. Identify the number 1 spark plug wire connection on the old distributor cap.

12. Using the tire crayon, mark the number 1 spark plug wire connection on the side of both the old and new distributor caps.

13. Transfer the number 1 spark plug wire to the new distributor cap.

Note: The new wire must follow the same route as the old wire.

14. Select the next wire connection located clockwise from the number 1 spark plug wire connection. Transfer this wire to the corresponding position on the new distributor cap.

15. Repeat the procedure to replace the remaining spark plug wires.

16. Check that the new spark plug wires are securely connected.

17. Check that the distributor cap is fully seated on the distributor housing.

18. Check that the hold-down fasteners are properly tightened or latched.

19. Start the engine to ensure that the spark plug wires are connected properly.

20. Check and reset the timing as required.

Safety Note: Avoid contact with moving parts.

21. Remove the fender covers, and close the hood.

22. Return the vehicle to the parking area.

23. Ensure windows are rolled up and doors are locked.

24. Return the keys to the teacher/supervisor.
25. Clean and return all equipment, tools and supplies to their proper storage areas.
26. Clean up the work area.
27. Using the following chart as a guide, evaluate your performance.

Replacing a Distributor Cap and Rotor	Excellent 4	Very Good 3	Good 2	Not Acceptable 1
The proper equipment, tools and supplies were selected.				
All steps in the procedure were completed.				
Distributor cap and rotor were secured.				
Each spark plug's wiring was correctly connected.				
Each spark plug's wire connection was secured.				
Ignition timing was correctly checked and adjusted.				
All related safety practices were followed.				
Work time was used effectively.				
A professional attitude toward others was demonstrated.				
The equipment and tools were properly handled.				
Cleaned and returned all equipment, tools and supplies to their proper storage areas.				
Cleaned up the work area.				

DISCUSSION TOPICS

1. Why do distributor caps and rotors deteriorate?

2. What problems are associated with defective distributor caps and rotors?

WORK STANDARDS AND MANAGEMENT

The major tasks of employees in any industry are to provide quality service and maintain positive relationships with clients and fellow employees. To achieve these goals, every supervisor expects certain standards to be met.

STUDENT ACTIVITIES

Below each of the following types of standards, list the behaviours that an employer expects from each employee.

PERSONAL STANDARDS

REGULATORY STANDARDS

MATERIALS-USE STANDARDS

INTERPERSONAL STANDARDS

Throughout the course, you will be evaluated on how well you are meeting different standards.

At the end of each month, make a copy of one or both of the following charts and evaluate your performance.

- Appendix 2: "Work Standards and Management Monthly Evaluation Chart".
- Appendix 3: "Self-evaluation Chart: Work Habits".

Check previous evaluations and note the improvements.

In addition to your self-evaluations, your teacher in school and supervisor in the workplace will evaluate your progress on the job. You may also be asked to evaluate the learning experience of each community partnership.

STUDENT ACTIVITIES

1. At the end of each community partnership:
 - a. Ask the employer or supervisor to evaluate your performance on the job. Give the employer or supervisor a copy of Appendix 4: "Community Partnership Evaluation Form (Community Partner)" and request that it be completed and returned to the school.
 - b. Complete a copy of Appendix 5: "Community Partnership Evaluation Form (Student)". Make copies of the completed form, and give one to your teacher and another to your community partner.

AUTOMOTIVE SERVICES 36 PROFILE

JOB SCOPE	1	Identifies future career opportunities	2	Conducts a job search
EQUIPMENT, TOOLS AND SUPPLIES	1	Identifies and records condition of equipment and tools	2	Maintains inventory of supply items
			3	Maintains inventory of major groups of hardware
PARTS OF A VEHICLE	1	Records details of condition of major parts of vehicle on customer record sheets		
ENGINES AND ENGINE SYSTEMS	1	Demonstrates entry-level skills in engine and engine system identification	2	Demonstrates entry-level skills in the use of vehicle hardware, sealants and related tools
			3	Demonstrates awareness of interrelationship between all systems
			4	Performs a basic vehicle inspection
	5	Demonstrates the ability to identify basic condition of parts of vehicle		
EQUIPMENT, TOOLS AND SUPPLIES USAGE	1	Demonstrates entry-level skills in using basic equipment, tools, testers and measuring devices	2	Demonstrates the use of electrical testing equipment: voltage, current, resistance
			3	Demonstrates safe use practices
VEHICLE CLEANING	1	Demonstrates entry-level skills in vehicle cleaning (detailing)	2	Evaluates own performance
BASIC AUTOMOTIVE MAINTENANCE	1	Demonstrates ability to perform basic maintenance services	2	Writes sales or work orders
			3	Calculates work order costs

AUTOMOTIVE SERVICES 36 PROFILE

MECHANICAL SERVICES	1	Identifies the components of a charging system	2	Identifies problems related to a charging system	3	Identifies the components of a starting system	4	Recognizes problems related to a starting system: starter, solenoid, wiring, battery
	5	Demonstrates entry-level ability to identify basic problems and possible causes of vehicle problems and to assist mechanic in performing services	6	Demonstrates entry-level safe practices	7	Demonstrates entry-level ability to adjust carburetors	8	Demonstrates ability to adjust ignitions: plugs, ignition timing
	9	Evaluates own performance						
WORK STANDARDS	1	Demonstrates pride in work	2	Demonstrates employment-level standards of performance	3	Maintains standards set by teacher/supervisor	4	Evaluates own performance
SUPPLIES MANAGEMENT	1	Demonstrates entry-level supply management skills	2	Evaluates own performance				
WORK AREA MANAGEMENT	1	Demonstrates leadership and initiative	2	Locates specific technical references	3	Maintains clean, safe work area	4	Evaluates own performance

WORK STANDARDS AND MANAGEMENT MONTHLY EVALUATION CHART

Name _____ Date _____	Evaluation	
	Satisfactory	Unsatisfactory
DEMONSTRATES APPROPRIATE WORK HABITS		
Is punctual		
Comes prepared to work		
Prepares immediately for work		
Performs duties as instructed, with acceptable accuracy		
Uses time productively		
Considers solutions to problems before asking for assistance		
FOLLOWS RULES AND REGULATIONS		
Follows acceptable safety and sanitation procedures		
Does not bring food or drink into the work area		
Dresses appropriately		
Uses equipment, tools and supplies as instructed		
Clears work area after use		
Performs required clean-up duties		
DEMONSTRATES CONCERN FOR SAFETY		
Demonstrates safety practices		
Maintains a safe and sanitary work area		
Wipes up spills immediately		
Does not leave work area without permission		
DEMONSTRATES PROFESSIONAL ATTITUDE		
Displays a professional appearance		
Is friendly and courteous		
Advises teacher/supervisor of hazards or necessary repairs		
Informs teacher/supervisor in advance of necessary absences		
Demonstrates responsibility for completion of assignments and tasks		
Follows verbal and written instructions		
Demonstrates an organized work approach		

Areas to improve next month are:

SELF-EVALUATION CHART: WORK HABITS

Name: _____ Date: _____ Course: _____			
Time Management	EVALUATION Excellent → Poor		
	1	2	3
Arrives on time			
Brings all necessary equipment to class			
Prepares immediately for work			
Performs duties without being asked			
Uses extra time to complete unfinished work			
Considers solutions to problems before asking for assistance			
Completes work on time			
Task Management			
Uses equipment and implements as instructed			
Cleans work area after use			
Performs daily clean-up duties			
Follows lab/class rules and regulations			
Personal Management			
Is well groomed			
Wears clothing appropriate to the task			
Maintains accepted standards of personal and public hygiene			
Safety			
Takes all necessary safety precautions			
Uses appropriate safety devices (clothing, shields, guards, etc.)			
<div style="display: flex; justify-content: space-between;"> Best Score: 45 Score Attained: _____ </div>			
<div style="display: flex; justify-content: space-between;"> Student's Signature: _____ Teacher's Signature: _____ </div>			

COMMUNITY PARTNERSHIP EVALUATION FORM

(Community Partner)

STUDENT _____				
COMMUNITY PARTNER _____			Period of Partnership From _____ to _____	
TYPE OF BUSINESS _____			PERFORMANCE LEVEL	
			High	Med
			Low	N.A.
1. <u>Career Awareness</u> a. Appreciates the nature of the industry/business b. Identifies variety of jobs/careers in occupational cluster c. Appreciates the need for job search skills d. Appreciates the job requirements e. Dresses appropriately for the job				
2. <u>Human Relations</u> a. Maintains good relations b. Communicates effectively c. Practises ethical behaviour d. Demonstrates dependability e. Demonstrates interest in area f. Adheres to work standards g. Displays a positive attitude h. Respects the opinions and property of others				
3. <u>Core Skills</u> a. Follows instructions/directions b. Completes necessary forms c. Uses metric/imperial measures d. Demonstrates entry-level math functions e. Demonstrates entry-level tools and equipment competencies f. Demonstrates entry-level ability to handle supplies				
4. <u>Work Skills</u> a. Demonstrates appropriate competencies b. Demonstrates pride in work c. Demonstrates entry-level sanitation practices d. Demonstrates entry-level safety practices e. Shows initiative f. Shows creative ability g. Practises effective time management				
5. <u>Entrepreneurship</u> a. Recognizes possible self-employment opportunities				
6. Other Comments				
Teacher: _____ Student: _____			Community Partner: _____	

COMMUNITY PARTNERSHIP EVALUATION FORM (Student)

1. Do you feel that this experience:

a. has been of benefit to you?

Yes ____

No ____

How? _____

Why not? _____

b. has helped to prepare you for the world of work?

Yes ____

No ____

How? _____

Why not? _____

c. has expanded your learning opportunities?

Yes ____

No ____

How? _____

Why not? _____

2. What difficulties arose?

3. What strengths/abilities did you discover in yourself as a result of this experience?

4. Do you have any suggestions for improving this program?

Placement Location _____

Date _____

Employer/Supervisor _____

Student _____

(signature)

(signature)

JOB SHEET EVALUATION RECORD

JOB SHEET	EVALUATION								
	Self			Peer			Teacher/Supervisor		
	1	2	3	1	2	3	1	2	3
1. Identifying Job Requirements									
2. Preparing a Résumé									
3. Composing a Letter of Application									
4. Completing a Job Application Form									
5. Preparing for and Participating in a Job Interview									
6. Identifying Employment Opportunities									
7. Inspecting and Sharpening a Twist Drill									
8. Inspecting and Repairing a Chisel									
9. Inspecting, Maintaining and Repairing Shop Equipment									
10. Performing Tool Room Duties									
11. Taking a Tool Room Inventory									
12. Performing Parts Room Duties									
13. Identifying Vehicle Parts									
14. Detailing a Vehicle									
15. Inspecting a Vehicle Body									
16. Inspecting a Vehicle Frame									
17. Inspecting the Ball Joints									
18. Inspecting the Springs									

JOB SHEET EVALUATION RECORD

JOB SHEET	EVALUATION								
	Self			Peer			Teacher/Supervisor		
	1	2	3	1	2	3	1	2	3
19. Inspecting the Shock Absorbers									
20. Inspecting the Control Arm Bushings									
21. Inspecting the Tires									
22. Inspecting a Rack and Pinion Steering System									
23. Inspecting a Parallelogram Steering System									
24. Inspecting the Brake System									
25. Performing a Compression Test									
26. Performing a Vacuum Test									
27. Performing a Crankcase Blow-by Test									
28. Performing a Cylinder Leakage Test									
29. Performing a Power Balance Test									
30. Inspecting an Engine for Oil Leaks									
31. Inspecting the Exhaust System									
32. Inspecting the Cooling System									
33. Pressure Testing a Cooling System									
34. Inspecting Fan Belts									
35. Power Flushing a Cooling System									
36. Replacing a Top Radiator Hose									

JOB SHEET EVALUATION RECORD

JOB SHEET	EVALUATION								
	Self			Peer			Teacher/Supervisor		
	1	2	3	1	2	3	1	2	3
37. Replacing a Thermostat									
38. Inspecting a Clutch									
39. Inspecting a Standard Transmission									
40. Inspecting an Automatic Transmission									
41. Inspecting a Drive Shaft									
42. Checking Rear Axle Assembly Gear Oil									
43. Inspecting a Rear Axle Assembly									
44. Inspecting Constant Velocity Joints									
45. Replacing a Headlight									
46. Replacing a Fuse									
47. Servicing a Battery									
48. Replacing a Battery Cable Clamp									
49. Replacing a Battery									
50. Performing a Battery Voltage Test									
51. Performing a Starter Current Draw Test									
52. Performing an Alternator Output Voltage Test									
53. Performing a Spark Plug Wire Resistance Test									
54. Replacing Spark Plugs									

JOB SHEET EVALUATION RECORD

JOB SHEET	EVALUATION								
	Self			Peer			Teacher/Supervisor		
	1	2	3	1	2	3	1	2	3
55. Adjusting Ignition Timing									
56. Performing an Ignition Timing Advance Test									
57. Replacing Spark Plug Wires									
58. Replacing a Distributor Cap and Rotor									

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